Are Commodity Price Booms an Opportunity to Diversify? Evidence from Resource-dependent Countries

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Abstract

The recent commodity price drop has renewed attention on the importance to diversify resource-dependent economies in particular to limit their exposure to commodity price volatility. While commodity price booms can be an opportunity to diversify the economy if managed properly, it remains an empirical question whether this has effectively been the case.

Using a panel of 78 resource-dependent countries over 1970-2012 we tackle this question thanks to cointegration analysis, dynamic macro-panel estimators, as well as analyses of diversification outcomes during selected commodity price boom and bust episodes.

While our econometric results evidence a stable and significant impact of commodity price booms on export concentration through a more concentrated mix of already exported products, this relationship includes both an increase in export concentration during commodity price booms and an increase in export diversification during commodity price drops. We also evidence a higher increase in export concentration during the 2000s commodity price booms than the 1970s, which explains the urging current need of most resource-dependent countries to diversify.

Keywords

Export diversification; Commodity price booms and busts; Structural transformation; Quality upgrading.

JEL codes

F14, O13, O14, Q02

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Summary

1. Introduction

Since the recent commodity price drop, numerous resource-dependent countries have faced a situation in which their resource sector has not been able to sustain their economy as a source of resource revenues or foreign exchange reserves. As a result, some of them may have missed the opportunity to diversify their economic structure during the preceding commodity price boom.

While a growing number of these countries accumulated sizable reserves during the preceding commodity price boom, it triggers the question of the relevance of such policies when the domestic financing needs are important and the domestic return of capital investment exceeds the return on international financial markets. While not contemporaneously related to a more diversified economy, investments in infrastructure, energy provision, and human capital can be the foundations for a more diversified economy producing products of higher quality in the longer run.

According to the resource curse literature[1] export diversification can be seen as a desirable feature because macroeconomic volatility could be a main explanation of the resource curse (Van der Ploeg and Poelhekke, 2009). Moreover, exports diversification can promote job opportunities for countries heavily dependent on some capital-intensive commodities such as hydrocarbons, and limit social unrest. Popularized by the Netherlands experience in managing natural gas wealth in the 1960s, the Dutch disease phenomenon formalized by Corden and Neary (1982) can also become an undesirable pattern. A commodity windfall can provide factor reallocation toward the resource sector (resource allocation channel) and provide increased sources of spending which could trigger exchange rate overvaluation, a loss of price competitiveness and a decrease in the size of the non-resource tradable sector (spending channel). This pattern can be especially detrimental if it crowds-out the manufacturing sector[2] which can provide positive externalities to the rest of the economy.

As a result, diversification is often seen as a policy objective for an economy and to a better extent for an economy heavily reliant on exhaustible commodities such as minerals or hydrocarbons. While it is unclear according to trade theories whether export diversification is optimal or not (Cadot et al, 2013), it can be seen as a desirable recommendation for countries over-reliant on commodity price fluctuations. Nevertheless, it should be stressed that among resource-dependent countries, some countries like Botswana (Pegg, 2010) managed to maintain a resource-based economy with good economic outcomes even though it is still unclear whether such experiences could be replicated elsewhere.

Not all diversification patterns may be alike so that the type of activities in which a country specializes can be important. As a result, specializing in goods of higher quality or produced by more developed economies could be more conducive to economic growth (Hausmann et al, 2007). One can see in a network view the production scope as a production tree with more sophisticated products localized in clusters of activities. Initially specializing in core activities provides further diversification potential in related activities while initial endowment in peripheral products like minerals provide limited potential for economic diversification.

Following the study of Imbs and Wacziarg (2003), a great part of the literature on diversification focused on the pattern of diversification along the development path. This pioneer work evidenced a U-shape pattern with countries diversifying their economy at earlier stages of development before re-specializing. While this result has been confirmed for export diversification (Cadot et al, 2011), some recent papers cast some doubt on this non-linear relationship and find a positive linear trend of export diversification along the development path (Parteka and Tamberini 2013, Mau 2016). Beyond the level of economic development, Agosin et al (2012), provide one of the first empirical studies on panel data assessing various determinants[3]. Various studies have followed focusing on different channels impacting export diversification.

[1] Frankel (2010) and Van der Ploeg (2011) provide extensive surveys of the literature surrounding the resource curse.
[2] The decreasing size of the manufacturing sector can also be associated with an increased productivity in the manufacturing sector moving less productive workers away from the sector (Kuralbayeva and Stefanski, 2013).
[3] They find some importance of geographic remoteness, lower trade openness, lower RER volatility, and human capital accumulation in increasing export diversification.

Trade facilitation agreements seem conducive to more export diversification (Beverelli et al, 2015) even though different types of trade agreements can have diverging effects (Persson and Wilhelmsson, 2016). Nicita and Rollo (2015) also find that both direct and indirect improvements in market access conditions have increased export diversification among Sub Saharan African countries. Financial development can increase the likelihood of a firm to export to a larger number of countries especially for financially-dependent sectors (Chan and Manova, 2015). Makhlouf et al (2015) suggest that trade openness leads to export specialization in autocracies and export diversification in democracies. Domestic institutional reforms can also impact the diversification pattern as evidenced by Sheng and Yang (2016) for China, who show that FDI ownership liberalization, improvement in contract enforcement and a reduction of offshoring costs have been associated with an increase in exports variety. While FDI flows can improve export diversification, the origin of the flow may also matter, with South-South FDI flows increasing export diversification and quality upgrading more than North-South flows (Amighini and Sanfilippo, 2014). Wiig and Kolstad (2012) provide a political economy explanation of diverging diversification experiences, emphasizing the importance of rent-seeking behavior of the ruling elites in impeding diversification in resource-rich countries if it decreases their own interests in the economy. Finally, Habiyaremyie (2016) pointed out that "Angola-mode-deals" between Chinese companies and African governments has improved export diversification thanks to a reduction in the infrastructure bottlenecks negotiated against the access to natural resources.

When analyzing the diversification of an economy, we face the challenge of identifying the relevant indicator. We can identify 3 main indices of export diversification in the literature with their own benefits and challenges (Theil index, Herfindahl index, Gini index)[4]. One advantage of the Theil index is the possibility to disentangle between the intensive margin component (rebalancing of existing product lines) and the extensive margin component (creation of new product lines). Measures of diversification also differ depending on what they measure, some indices focusing on export partners' diversification, export diversification, or output diversification. Closely related measures also include the pattern of structural transformation[5] (value-added importance of the primary or manufacturing sector in the economy) or the quality upgrading of products. While focusing mainly on export diversification measured by each component of the Theil index, we also extend the analysis to quality upgrading and structural transformation.

Another challenge when analyzing the evolving structure of an economy is to disentangle various channels which could affect the outcome with various lags. Among the common determinants of a diversified economy we may think of short-run determinants such as price competitiveness[6], medium-run determinants such as financial development, political and economic institutions, trade policy measures (commercial agreements, trade barriers), long-run determinants such as the stock of human capital or the quality of infrastructures. On top of that, one may think about quasi country-specific determinants which include geographic remoteness[7] or the type of former colony[8]. Analyzing the dynamic impact of commodity price booms on diversification, this analysis will focus mainly on a short-to-medium run perspective.

The literature on diversification often focuses on a heterogeneous sample of countries which includes both resource-rich and resource-poor economies. While resource-poor economies face their own challenges for diversifying and upgrading their production, it seems important to provide some insights for resource-dependent countries, which may suffer most from excessive specialization in the resource sector. This paper also provides an opportunity to analyze the impact of commodity price booms not only on the evolution of the manufacturing sector through Dutch disease effects but also on export diversification and quality upgrading.

[4] See Cadot et al (2013) for an extensive discussion of their pros and cons.

[5] Structural transformation often defined as the dynamic reallocation of resources from less productive to more productive sectors will be considered here through the evolution of the value-added share of the manufacturing sector in the economy. McMillan and Rodrik (2014) provide evidence for the impact of structural transformation on economic development through the reallocation of labor from low-productivity activities to higher-productivity activities.

[6] While exchange rate undervaluation is seen as a standard driver of both exports growth and diversification, Sekkat (2016) finds no evidence of this channel.

[7] Even geographic remoteness can be seen as an evolving component depending among other things on the existing trade flow networks or the transport costs.

[8] The number of years between the start of oil production and a country political independence seems to be positively related to more diversified exports (Omgba, 2014), so that the type of colony (extractive colonies or settlers' colonies) and its related institutions still impact current economic outcomes.

When analyzing policies for countries relying on their resource sector we face the problem of identifying the relevant countries. One main criticism of the past resource curse literature has been to rely excessively on resource-dependence indices because they are an endogenous driver of resource growth[9]. In our case, we are less worried about this issue because our aim is to select countries whose resource sector is important for the economy. A selection based on resource abundance would be less relevant because it would include under-the ground reserves not already exploited which would give a misleading picture. Resource rent does not seem to be an option because of the lack of comparable index with a large country and commodity coverage[10]. As a result, we select in this analysis countries according to their resource-dependence pattern, so that the resulting sample consists of 78 resource-dependent countries over 1970-2012.

We first perform a cointegration analysis in order to test the cointegration relationship between diversification improvements and commodity price variations and estimate a Pooled Mean Group (PMG) model which enables both short term and error correction term coefficients to be country-specific while the long-run relationship is restricted to be the same across countries. While analyzing the importance of the resource sector, one may wonder which commodities are relevant to include in the study. Different types of commodities trigger their own challenges. Some papers restrict their analysis to point-source resources (mainly exhaustible minerals, hydrocarbons, and cash crops) which are often easier to control and to extract rents. Exhaustible resources trigger their own challenges regarding intergenerational equity and dynamic resource exploitation and management. Another difference may arise between capital-intensive and labor-intensive commodities[11]. While first considering the resource sector as a whole in our baseline estimates, we will provide some estimations using different commodity classifications.

However, commodity-dependent countries are affected heterogeneously by some global factors (US monetary policy, the oil price variations, global crisis…) which lead to reject the assumption of cross-section independence in the PMG model. As a result, we have carried out our baseline regressions using a Common Correlated Effects Mean Group (CCEMG) model which takes into account cross-section dependence. We also provide some robustness checks in this analysis. We find a significant positive impact of commodity price variations on export concentration through a concentration of already exported products.

While our previous models have analyzed the overall relationship between commodity price variations and diversification developments, we then restrict our analysis to periods of significant commodity price booms and busts. We develop a methodology to identify these relevant episodes and analyze the evolution of the diversification indicators during these time spans. Countries facing a major commodity price boom have significantly concentrated their exports but have diversified during major commodity price busts. While we found evidence of a decrease in the manufacturing sector value added share during commodity price booms, we failed to find any significant evolution during commodity price drops.

Comparing the evolution of our diversification indicators during commodity price boom episodes occurring in the 1970s and in the 2000s we have found a greater concentration of exported products during the 2000s booms than in the 1970s which explains partly the current difficulty of undiversified economies to recover in the new context of low commodity prices.

This paper is organized as follows. We first explain the computation of our data before giving some preliminary relationships between commodity price variations and the diversification pattern in section 2. Our empirical strategy is explained in detail in section 3 from the cointegration relationship, to the common correlated effect model, and the commodity price booms and busts analysis. Section 4 thus provides our empirical results before giving some policy lessons in section 5.

[9] Authors then relied on indices of resource abundance which is not strictly exogenous and on resource rents whose data are scarce and often concentrated on oil production.

[10] The natural rent index of the World Bank database on wealth distribution would have been an alternative but it takes into account under the ground resources, does not give estimates for some countries, has a limited time-coverage, and does not include mining products such as diamonds which represent a great share of production in economies like Botswana or Central African Republic.

[11] Van der Ploeg and Rohner (2012) suggest that the likelihood of a conflict increases with a rise in capital-intensive resources (oil, natural gas…) but with a decrease in labor-intensive resources (coffee, rice…)

2. Preliminary data

2.1. Relevant country coverage

As said above, we restrict our focus on countries dependent on natural resources in order to study the change in diversification for countries that should need it the most. We classify countries as dependent on natural resources when their share of commodity exports exceeds 40% of total goods and services exports over 2003-2007[12]. While it would have been better to get accurate data at the beginning of the time sample in order to select our countries, we prefer as a second-best to select countries according to their dependence on natural resources over the period used in order to compute their commodity export shares[13].

The resulting sample consists of 78 countries over 1970-2012[14]. While the diversification indices used in this paper only cover our sample until 2010, we have used two further years for regressions using the ratio of manufacturing value added in order to get more insights for the last years following the 2000s commodity price boom.

2.2. Country specific commodity price indices

In order to capture country-specific commodity price variations, we compute a Country-Specific Commodity Price Index (*CSCPI*) as a weighted average of commodity prices weighted by the relative importance of each commodity in commodities exports over 2003-2007. The commodity export weights cover 53 commodities including 28 food products, 6 raw agricultural materials, 15 mining products, and 4 fuel products. We describe the matching between trade and commodity price data in appendix 3.

We rely on the pattern of commodity specialization over 2003-2007 in order to capture the real pattern of commodity dependence over 1970-2012. We have selected this period because it was the oldest period for which we could get a comprehensive pattern for most of our countries and as a result the most comprehensive data coverage. Another possibility would have been to use an index whose commodity weights would have been time-varying but it would limit the exogeneity of our index. On top of that, while the ratio of commodity dependence may have evolved over four decades, we may think that the commodity specialization within the commodity sector would not have changed so much. Appendix 4 provides descriptive tables which include these country-specific commodity weights for commodities whose weights exceed 5% of the computed basket of exported commodities.

2.3. Diversification patterns

As explained by Cadot et al (2013), there are three main indicators of diversification in the literature: The Herfindhal index, the Theil index, and the Gini index. Even though the Herfindhal index has been often used in empirical studies, we have used the Theil index for two main reasons. First, the Theil index can be decomposed in an intensive margin diversification index catching the rebalancing of existing product lines and an extensive margin diversification index taking into account new product lines, which could provide further insights for our empirical study. Moreover, we

[12] While this threshold may seem ad hoc it stands slightly above the median commodity exports share (30.6%) in order to remove some countries only partly dependent on natural resources. It has also been motivated by the slightly higher average share of commodity exports share over that period because of higher commodity prices. Appendix 1 provides a geographic representation for the share of commodity exports in total goods and services exports over that period.

[13] It is difficult to get relevant estimates for some important product lines such as diamonds and precious stones or non-monetary gold apart from UNCTAD data which are available from 1995. Moreover, the 2003-2007 period has been selected because it maximizes our country coverage, detailed export data being unavailable before for some countries. An alternative would have been to use the importance of the natural resource sector value added in total GDP but the discrepancy between the ISIC (for value added sectors) and SITC (for exports sectors) prevent us from using it. For instance, numerous partly transformed goods classified as agricultural or mining products under the SITC are included in the manufacturing sector (sector C) under the ISIC, giving a misleading pattern or resource dependence.

[14] Appendix 4 describes the specialization patterns of these countries, while appendix 2 and 3 explain the methodology behind the aggregation of commodity exports, and the matching between trade and price data.

benefit from Theil indices originating from the IMF database[15] on export concentration constructed thanks to the UN-NBER database on trade flows over 1962-2010, which to our knowledge is the database with the largest time and country coverage available on export concentration. A higher value of the concentration indices refers to a less diversified economy and conversely.

As a result, this study will cover 5 indicators of diversification: the composite Theil index of export concentration, the intensive margin index, the extensive margin index, an index for the quality of exported goods, as well as the manufacturing value added share over GDP. While the first three indicators are directly related to export diversification, we use the last two in order to get some insights into the impact of commodity price booms on quality improvement (proxied by the quality index of exported goods[16]) and structural transformation (proxied by the manufacturing value added share over GDP).

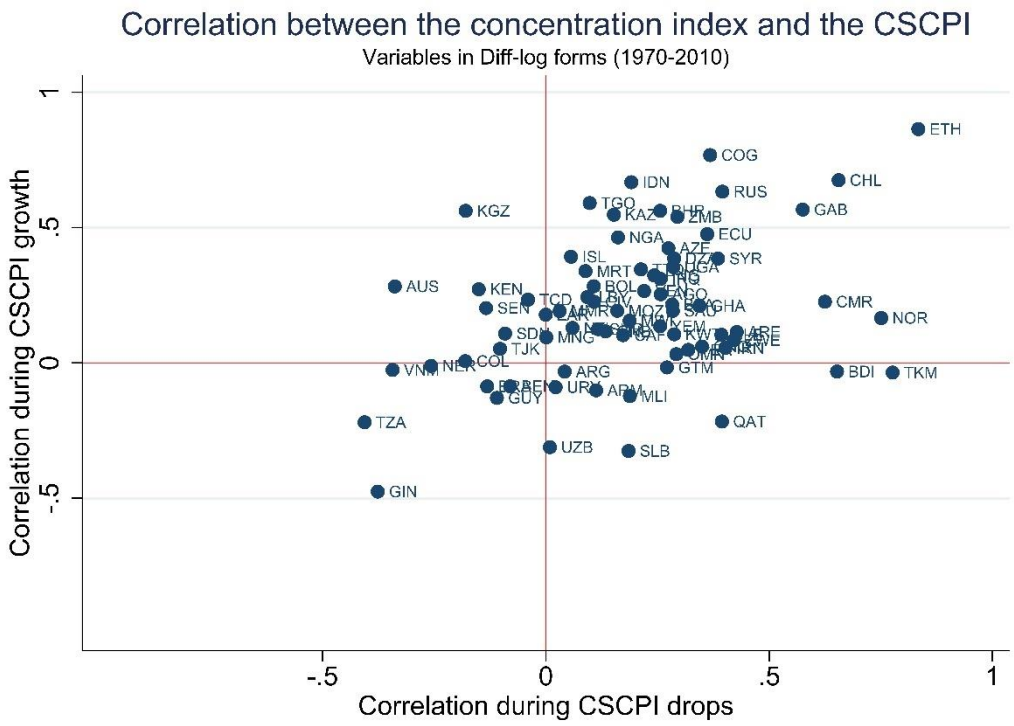
In order to get some preliminary insights, we present some graphics plotting country-specific Pearson correlation coefficients between the log of our indicators and the log of CSCPI during periods of CSCPI increase[17] growth against the same country-specific correlation coefficients under periods of CSCPI drops[18].

We should remind that our export concentration indices and its extensive and intensive margin components are coded so that a lower value corresponds to a higher level of diversification. In graphs 1.a 1.b and 1.c, countries in the top-left corner would have concentrated their exports both in periods of commodity price increase and decrease, countries in the bottom-right corner would have diversified their exports in both periods, countries in the bottom-left corner would have diversified their exports during commodity price increases and concentrated their exports during commodity price decreases, while countries in the top-right corner would have diversified their exports during commodity price decreases and concentrated their exports during commodity price increases.

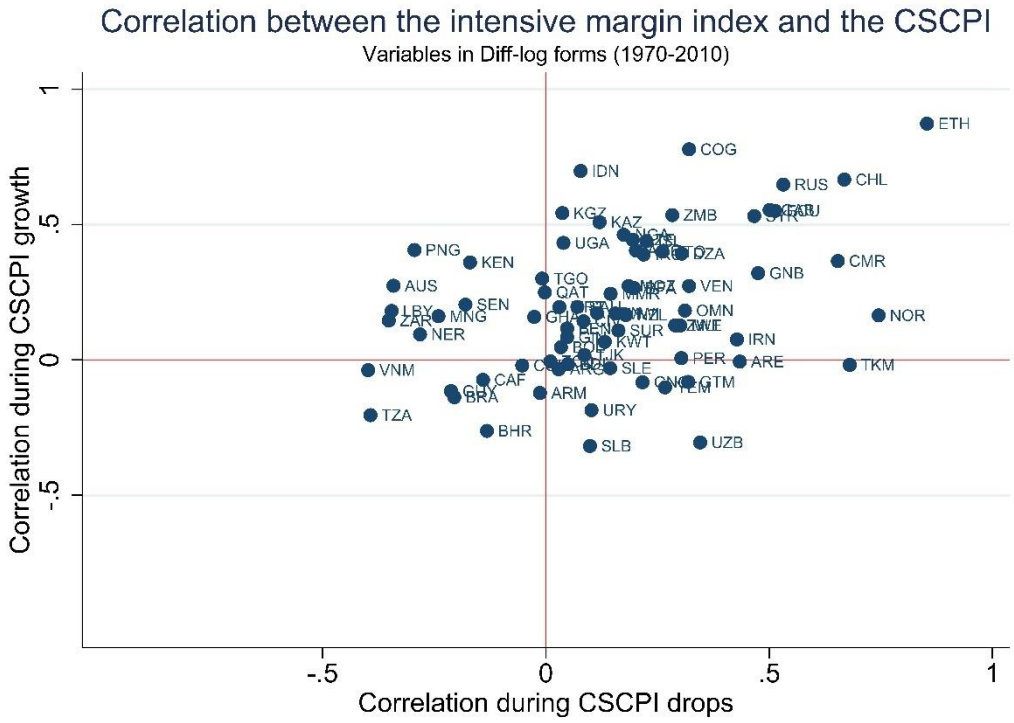
At first sight, a sizable number of countries are situated in the top-right corner which means that those countries have diversified their exports during bad periods and concentrated during good periods even though the pattern is mixed for the extensive margin index.

Regarding graphs 1.d and 1.e, the interpretation should be the reverse so that countries having increased the relative quality or the manufacturing value-added share in both periods are now situated in the top-left corner and countries having decreased the relative quality or the manufacturing value-added share in both periods are in the bottom-right corner. Even though some heterogeneity exists in graph 1.d, half of our countries are located in the bottom-left corner for the quality index which means they would have increased the overall relative quality of their exports during commodity price decreases and decreased it during price increases. Graph 1.e concerning the manufacturing value-added share depicts no clear pattern and warrants deeper analysis.

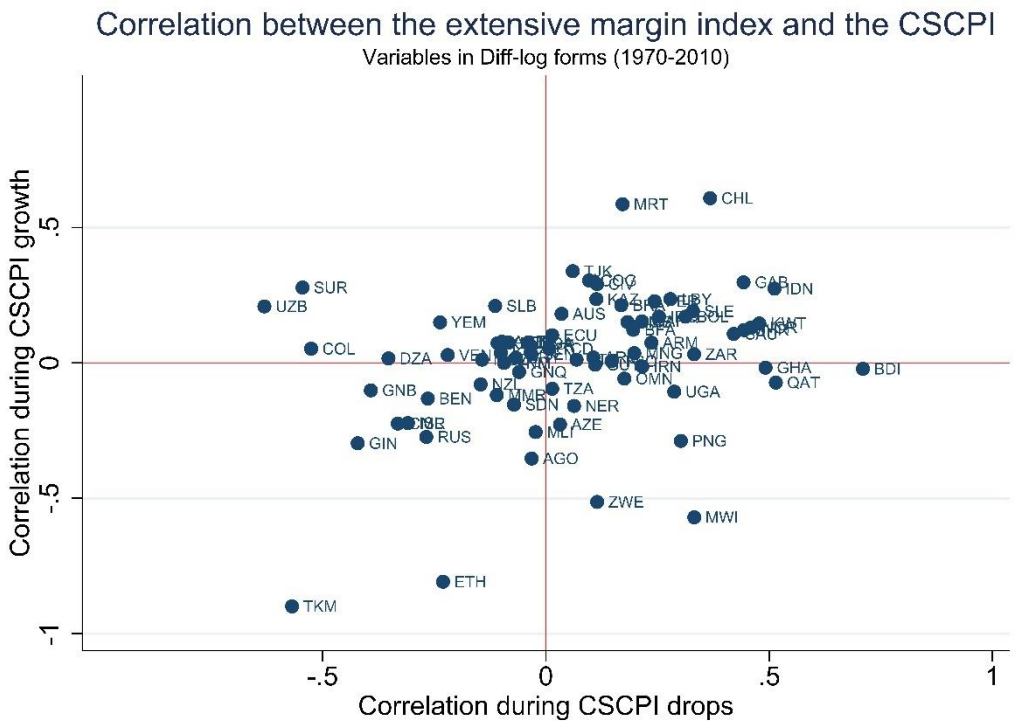
[15] See IMF (2014) for further details regarding the data.
[16] This index originates from the same IMF diversification database and has been constructed thanks to adjusted export unit values in relative terms so that the quality of exported goods is expressed relative to the world 90th percentile of quality for each exported good. See Henn et al (2013) for further details.
[17] A positive correlation coefficient during commodity price increases means an increase of the concentration index, that is to say a decrease in diversification, which corresponds to observations at the top of the graph.
[18] A positive correlation coefficient during commodity price drops means a decrease of the concentration index, that is to say an increase in diversification, which corresponds to observations on the right-hand side of the graph.



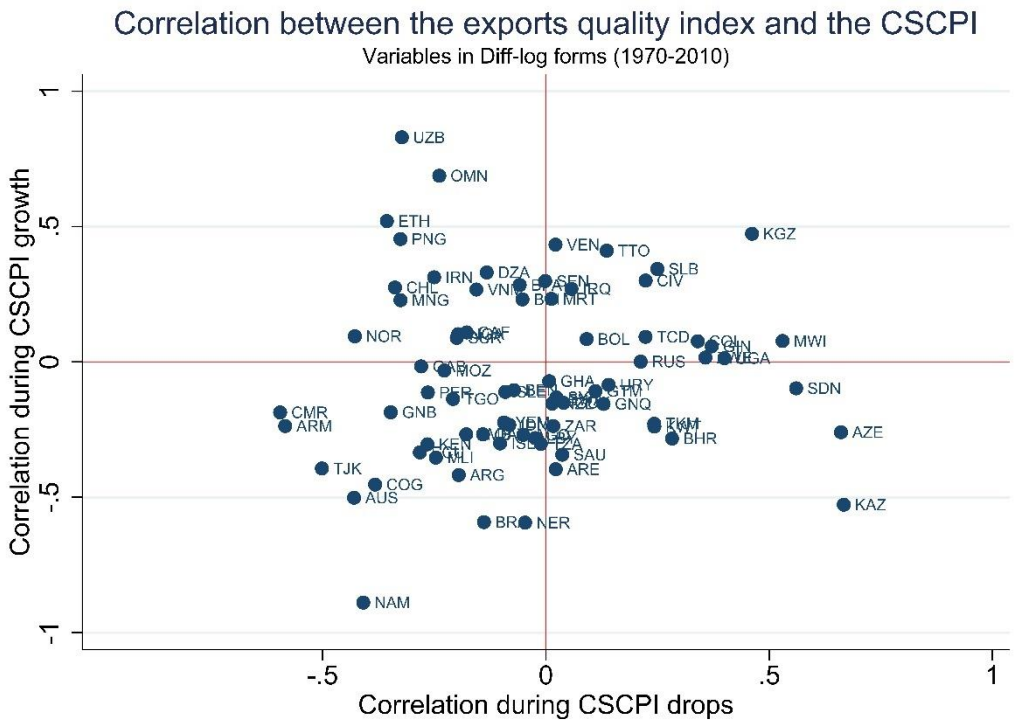
***Graph 1.a*: Simple correlation coefficients between the concentration index and the CSCPI during CSCPI growth and drops**



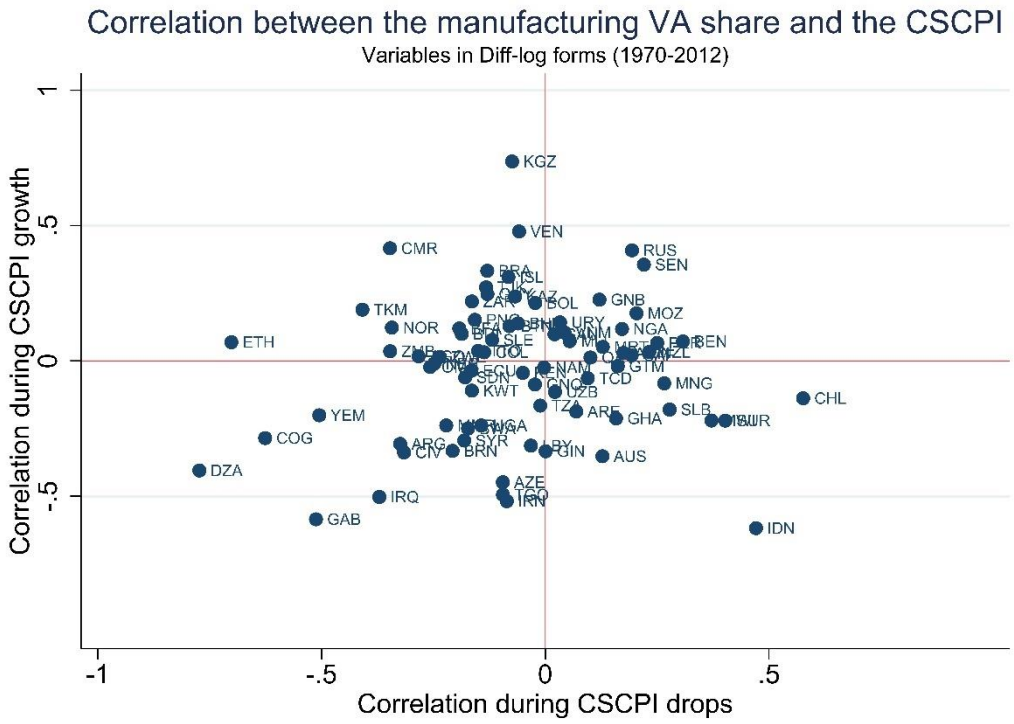
***Graph 1.b*: Simple correlation coefficients between the intensive margin index and the CSCPI during CSCPI growth and drops**



***Graph 1.c**: Simple correlation coefficients between the extensive margin index and the CSCPI during CSCPI growth and drops*



***Graph 1.d**: Simple correlation coefficients between the exports quality index and the CSCPI during CSCPI growth and drops*



Graph 1.e: Simple correlation coefficients between the manufacturing VA share and the CSCPI during CSCPI growth and drops

3. Empirical strategy

3.1. Cointegration analysis

A first step in the analysis could be to assess the non-stationarity properties of our main variables of interest leaving aside for the moment other control variables. In this section we will only focus on the concentration index (*Conc Index*) because it is our main proxy and we will study its relationship with the growth rates of commodity prices both in the short run and in the long run. We assess these properties with both Maddala and Wu (1999) and Pesaran (2007) tests. This latter improves on other panel unit root tests by taking into account potential cross-section dependence which may arise in our data due to common global shocks and cross-section spillovers. As a result, we will guide our analysis thanks to the Pesaran CIPS test.

Then we will be able to provide cointegration tests thanks to Westerlund (2007) that takes into account short-term country-heterogeneity as well as country-specific speed of adjustment in the cointegration relationship. In order to estimate the cointegration relationship, we will make use of the Pooled-Mean-Group (PMG) estimator developed by Pesaran et al (1999). This estimator improves on the Mean-Group (MG) estimator developed by Pesaran and Smith (1995) in that it restricts the long-run relationship to be homogenous across individuals, while enabling country-specific short-run responses and speeds of adjustment.

$$\Delta \ln(Conc\ Index_{i,t}) = \emptyset_i\left[\ln(Conc\ Index_{i,t-1}) - \theta' \ln(CSCPI_{i,t})\right] + \sum_{j=0}^{1} \delta'_{ij} \Delta \ln(CSCPI)_{i,t-j} + \varepsilon_{i,t} \quad (1)$$

Let equation (1) represent our PMG specification with $\emptyset_i$ a vector of country-specific error correction terms expected to be significantly negative, θ' the long-run estimated coefficient, δ'_{ij} a vector of country-specific short-run coefficients to be estimated, and ε_{it} and error term. The homogeneity of the long-run relationship is not straightforward especially with a panel of countries with heterogeneous levels of development and heterogeneous commodity specialization patterns. As a result, we will estimate the MG relationship for each specification and perform a Hausman test of the non-systematic difference between the coefficients of both models. If we fail to

reject the non-difference between the estimated parameters, it will validate the choice of the PMG estimator. We have included the contemporaneous commodity price variation as well as its first lag in order to control for potential lags in the relationship.

Even though we could only estimate a PMG model and check the aggregate significance of the speed of adjustment as a check of a cointegration relationship, we perform the Westerlund (2007) test for each specification and report the 4 statistics[19].

Because we are aware of the heterogeneity in commodity specialization, we group countries according to their type of specialization. As a result, a country belongs to one of the 4 groups; food exporters (*food*), raw agricultural materials exporters (*rawagri*), mining products exporters (*mining*), or energy exporters (*energy*), when its exports of commodities belonging to this group has exceeded 20% of total goods and services exports over 2003-2007[20]. We will provide PMG estimates as well as the associated tests for these 4 groups of countries, as well as a 5th group named as *exhaustible* which gathers countries whose exports of exhaustible commodities (proxied by the sum of mining and energy exports) exceeds 20%. There are numerous reasons for analyzing specifically this category because the commodities belonging to it are often more capital intensive, more point-source and more prone to rent-grabbing, as well as facing the challenge of exhaustibility.

3.2. Common correlated effects estimates

Even though the PMG estimator provides an efficiency improvement in comparison with traditional estimators, it fails to account for cross-section dependence which may arise because of common global shocks or spillovers between countries. This problem is all the most striking in our case because of the impact of global shocks on commodity price markets (US monetary policy, oil price variations, global financial crisis…). In order to control for these common factors that both affect our dependent and independent variables, Pesaran (2006) has developed a Common Correlated Effects (CCE) model which is a Mean-Group type of estimator so that it can be defined as a Mean-Group Common Correlated Effects (CCE) model.

$$Y_{i,t} = \beta_i X_{i,t} + u_{i,t} \ (2)$$
$$u_{i,t} = \alpha_{1i} + \lambda_i F_t + \varepsilon_{i,t} \ (2)'$$
$$X_{i,t} = \alpha_{2i} + \lambda_i F_t + \gamma_i G_t + e_{i,t} \ (2)''$$

Let equation (2) represent our main equation with $X_{i,t}$ a vector of explanatory variables, β_i a vector of country-specific coefficients, $Y_{i,t}$ our dependent variable, and $u_{i,t}$ containing the unobservable factors. In this model, $u_{i,t}$ can be explained in equation (2)' as a function of unobserved common factors F_t with heterogeneous factor loadings λ_i. Similarly, the vector of explanatory variables $X_{i,t}$ can be described in (2'') as a function of the same unobserved common factors F_t and another set of unobserved common factors G_t with γ_i being the heterogeneous factor loadings related to G_t. Let α_{1i} and α_{2i} represent country-specific constants, and $\varepsilon_{i,t}$ and $e_{i,t}$ are the error terms.

With the same functioning as the Mean-Group estimator, it estimates the relationship for each cross-section and averages the resulting coefficients β_i across individuals. We will use a version of the MGCCE estimator which is robust to potential outliers and gives a weighted average of each coefficients[21]. In order to control for the common global factors that affect the independent and the dependent variables in every country but with different strength as highlighted in equations (2)' and (2)'', the model augments the cross-section regressions with cross-section averages of the dependent and independent variables.

[19] Gt and Ga are statistics based on group-mean and test against the alternative hypothesis of at least one cointegration relationship among our countries, while the panel Pt and Pa statistics are built on the alternative hypothesis of a cointegration relationship for the panel as a whole.

[20] As such a country can belong to multiple groups such as Central African Republic which is considered both in the mining group and in the raw agricultural material group. Countries can also belong to no group if their commodity exports are split between each groups and fall below the threshold (Togo, Kyrgyzstan).

[21] This seems important in our study because while the IMF database has been implemented with great care, we cannot rule out completely the possibility of some swings in our indices related to customs methodology changes, changes of goods classification, a change in the taxation of exports (or imports because some trade figures were built thanks to mirror data).

This estimator presents the best trade-off in order to estimate the impact of commodity price variations on our diversification related variables, and will use it as our benchmark. The estimations have been carried out for each of the 5 dependent indicators of export diversification presented previously.

Unlike the previous section, we will introduce some control variables in the model. We will distinguish two types of control variables: permanent control variables which would appear in each specification and potential control variables which are introduced to check the stability of the main specification.

$$\Delta \ln(Div)_{i,t} = \beta_{0,i} + \beta_{1,i}\Delta \ln(CSCPI)_{i,t} + \beta_{2,i}\Delta \ln(REER)_{i,t} + \beta_{3,i} \ln(GFCF\ share)_{i,t} + \beta_{4,i} \ln(School)_{i,t} + \beta_{5,i}C_{i,t} + \varepsilon_{i,t} \quad (3)$$

Let equation (3) refers to our main empirical specification. $\Delta \ln(Div)_{i,t}$ refers to the diff-log form for alternatively each of our 5 dependent variables related to diversification: the concentration index (*Conc Index*), the intensive margin index (*Int margin*), the extensive margin index (*Ext margin*), the relative quality index (*Quality Index*), and the manufacturing value-added share (*Manu share*). Our main interest coefficient $\beta_{1,i}$ is related to commodity price variations proxied by the diff-log form of commodity prices $\Delta \ln(CSCPI)_{i,t}$. In specifications using the diversification indices, a positive value for $\beta_{1,i}$ would mean that commodity price variations evolve in the same direction as export concentration[22], while a negative value for $\beta_{1,i}$ would mean that commodity price variations evolve in the same direction as export diversification.

Our core of permanent control variables consists of Real Effective Exchange Rate *Δln(REER)* variations[23], the stock of human capital *ln(School)* proxied by the secondary school enrollment ratio (WDI) [24], as well as the stock of infrastructure *ln(GFCF share)* proxied by the share of gross fixed capital formation in total GDP (UNSTAT)[25]. This specification gives us 2 potential long-run determinants of the diversification pattern which are expressed in log, and two shorter-term determinants which are expressed in diff-log. The inclusion of REER variations is especially important because economists have evidenced for years a relationship between commodity price booms and REER appreciation triggered by increased domestic spending following the commodity price boom, and which progressively increases the price of tradable goods relative to non-tradable goods. Using variations of REER in our specification we control for this Dutch disease related spending channel so that the estimated coefficients on CSCPI variations could be interpreted as a direct effect of commodity price booms on the diversification indicator.

In order to confirm the validity of our results, we introduce one by one alternative control variables $C_{i,t}$. This includes the volatility of commodity prices *vol(CSCPI)*[26], the country labor market size *ln(pop active)* proxied by the stock of active population (WDI), the ratio of goods and services imports over GDP *ln* ($\frac{M}{GDP}$) as a proxy for trade openness[27], the financial development *ln(financial dev)* proxied by the ratio of liquid liabilities per inhabitants (World Bank Financial Development Structure Database), the Chinn-Ito index of capital openness rescaled to be bound

[22] We should keep in mind that a positive coefficient could be either the sign of export concentration during commodity price increases or export diversification during commodity price decreases.

[23] See appendix 5 for an explanation of the REER computation.

[24] Because of gaps in the data we have used the moving average using 4 lags and the contemporaneous data in our specifications in log, while we will refer to the original index for the Δln specifications.

[25] While imperfect, this proxy controls for the importance of capital investments which could be targeted towards energy supply, transport infrastructure, or telecommunication infrastructures, which are crucial to open new business activities.

[26] These series are computed as conditional standard deviations from a GARCH(1,1) model on monthly CSCPI series and averaged by year.

[27] We may expect a will to import a variety of products which could trigger export diversification. It may also catch some evolution of trade policies over time. The results remained apparently the same with the ratio of exports plus imports over GDP but we feel that the ratio of imports to GDP has more theoretical justifications.

between 0 and 1 *ln(capital open)*[28], the polity 2 index (Polity IV) rescaled to be bound between 0 and 1 *ln(democracy)*[29], and the log level of PPP GDP per capita *ln(PPP GDP pc)*[30] (WEO).

3.3. Selection of commodity price episodes

While the estimation of the CCEMG model will give us some great empirical insights into the relationship between commodity price variations and the evolution of the diversification pattern, these estimates have been carried out on every data observation. However, we may think that only periods of strong commodity price increase (defined as boom episodes) or strong commodity price drop (defined as bust episodes) should be relevant to study.

As such, we will provide some insights into the evolution of the diversification related indicators during the commodity price episodes defined previously. This strategy will enable us to catch longer-run impacts of commodity price booms/busts on diversification outcomes especially through the evolution of capital expenditure or human capital. However, it would have been better to compare pre-boom/bust and post-boom/bust periods to gauge their impact on diversification but we lack data observations before the 1970s boom and after the 2000s boom[31].

Our first task consists in identifying episodes of commodity price booms and busts in order to select periods in which the commodity price variations have impacted the most our selected countries. As a result, we benefit from the Country Specific Commodity Price Indices computed as described previously in order to identify these episodes.

A first methodology could have been to extract a stochastic cyclical component from our CSCPI series thanks to time-series filtering methodologies. However, filtering methodologies have been mostly used for identifying business cycle variations. One major difference between business cycles and commodity price cycles relies in the longer-duration of commodity price cycles which complicates the identification of commodity price cycles on our covered period of 41 years[32]. Moreover, filtering methodologies often perform poorly at both the beginning and the end of the time period, that is to say when we would need the most to identify episodes related to the 1970s and 2000s commodity price booms[33]. Thus, we relied on CSCPI variations directly in order to classify commodity price episodes.

We did not rely on direct growth rates from our CSCPI series because our empirical strategies will use some log or diff-log forms of our CSCPI series. As a result, we will consider hereafter commodity price growth as the difference between consecutive CSCPI observations in log forms.

First, we compute a positive cumulative price shock (*Cumshock*) which is the product of current plus past commodity price increases since the last commodity price drop. Alternatively, a negative cumulative price shock corresponds to the product of current plus past commodity price drops since the last commodity price increase.

[28] Capital openness can proxy the openness to FDI flows which can bring about new technologies and knowledge necessary in order to process new activities. Moreover, the liberalization of FDI inputs can provide huge efficiency gains for the domestic economy. However, capital openness can enable brutal capital reversals with its domestic destabilizing impacts.

[29] This proxy is far from perfectly catching the quality of institutions but it is really challenging to get a proxy for the quality of institutions with enough within variations which dates back to the 1970s. We have taken the polity2 indicator as a second best because it proxies above all political institutional output. It may control for the different determinants of capital investments and business operation between more democratic regimes and more autocratic regimes.

[30]This latter is a standard determinant of exports diversification in the literature motivated by the early empirical focus on the relationship between the level of economic development and export diversification. However, the level of development is too much correlated with relevant determinants such as the financial development (0.75), capital openness (0.54), or the school enrollment ratio (0.76) which complicates its inclusion among our key control variables, and leads us to include it only as a robustness check.

[31] The identified start of the 1970s commodity price boom has often been set to 1970 because we lack past data for some commodities while the boom may have started earlier.

[32] Burns and Mitchell (1946) defined standard business cycle variations as lasting from 1.5 to 8 years which correspond to commonly adopted parameters in filtering methodologies. However, commodity price cycles often referred as commodity price super-cycles seem to last between 20 and 70 years (Erten and Ocampo, 2013).

[33] Even though only the Baxter and King (1999) filter induces some loss of observation because it relies on moving averages, other filters like the Band-Pass Christiano and Fitzgerald (2013) or the High-Pass Hodrick-Prescott (1997) filters perform poorly at both ends of the sample. We tried both methodologies as well as the Butterworth (1930) methodology each with different parameters but it provided irrelevant commodity price episode selections.

Then we select commodity boom episodes when the peak positive cumulative price shock belongs to the top 10% of positive cumulative price shocks. Alternatively, we select commodity price bust episodes when the peak negative cumulative price shock belongs to the top 10% of negative cumulative price shocks[34]. While able to select continuous booms and busts this selection overlook some quick reversal of commodity price variations before a continuation of previous commodity price increase or drop.

To tackle this problem, we test for each year whether our adjusted cumulative commodity price shocks between the beginning and the end of the tested period still remain above the selected threshold of cumulative commodity price shocks. We perform these tests for years earlier and beyond the first selected period until the adjusted cumulative commodity price shock fall below the threshold. While this modification catches more relevant episodes it extends our selection of episodes further than necessary so we restrict the time periods from troughs to peaks or conversely.

The resulting sample presented in table 1 and 2 consists of 94 commodity price booms episodes in 56 countries and of 77 commodity price busts episodes in 68 countries.

[34] While one could think this threshold would poorly select commodity price episodes, we should remind that 10% of positive (negative) commodity price observations consists approximatively of 5% of our data sample because cumulative price shocks observation only includes positive (negative) commodity price variations. Moreover, some episodes include multiple observations of cumulative commodity price shocks above our threshold which incited us to select a less binding threshold. The threshold values for the cumulative shock are respectively +84.3% and -44.2%.

Country	Cumshock	Beginning	End	Duration	Country	Cumshock	Beginning	End	Duration
Algeria	325.1%	1970	1980	11	Kyrgyzstan	189.0%	1999	2011	13
Algeria	283.5%	1998	2008	11	Libya	328.2%	1970	1980	11
Angola	319.8%	1970	1980	11	Libya	329.3%	1998	2008	11
Angola	325.3%	1998	2008	11	Mali	105.8%	1970	1974	5
Argentina	93.0%	1970	1974	5	Mauritania	225.7%	2002	2010	9
Argentina	108.6%	1999	2008	10	Mongolia	224.6%	2001	2011	11
Australia	165.2%	1999	2011	13	Myanmar	104.0%	1970	1974	5
Azerbaijan	293.7%	1970	1980	11	Niger	89.4%	1970	1974	5
Azerbaijan	293.9%	1998	2008	11	Nigeria	325.6%	1970	1980	11
Bahrain	155.3%	1998	2008	11	Nigeria	323.4%	1998	2008	11
Bhutan	148.0%	2001	2008	8	Norway	270.6%	1970	1980	11
Bolivia	183.6%	1970	1980	11	Norway	241.4%	1998	2008	11
Bolivia	158.9%	1999	2008	10	Oman	320.1%	1970	1980	11
Brazil	98.2%	2002	2008	7	Oman	306.6%	1998	2008	11
Brunei	329.9%	1970	1980	11	Papua New Guinea	102.9%	1971	1974	4
Brunei	289.0%	1998	2008	11	Papua New Guinea	194.7%	2001	2011	11
Burkina Faso	89.8%	2009	2011	3	Peru	95.5%	1971	1974	4
Burundi	199.8%	2001	2011	11	Peru	199.3%	2002	2011	10
Cameroon	106.7%	1970	1974	5	Qatar	330.3%	1970	1980	11
Cameroon	160.6%	1998	2011	14	Qatar	289.0%	1998	2008	11
Chad	272.3%	1970	1980	11	Republic of Congo	272.7%	1970	1980	11
Chad	235.9%	1998	2008	11	Republic of Congo	281.8%	1998	2008	11
Chile	167.1%	2002	2011	10	Russia	248.3%	1970	1980	11
Colombia	228.5%	1970	1980	11	Russia	247.8%	1998	2008	11
Colombia	158.3%	1998	2008	11	Saudi Arabia	325.0%	1970	1980	11
Cote d'Ivoire	108.3%	1971	1974	4	Saudi Arabia	325.7%	1998	2008	11
Cote d'Ivoire	104.9%	1999	2008	10	Senegal	102.9%	1970	1974	5
Ecuador	198.9%	1970	1980	11	Sudan	283.7%	1970	1980	11
Ecuador	178.3%	1998	2008	11	Sudan	270.6%	1998	2008	11
Equatorial Guinea	323.7%	1970	1980	11	Syria	246.8%	1970	1980	11
Equatorial Guinea	324.2%	1998	2008	11	Syria	246.2%	1998	2008	11
Ethiopia	96.8%	2001	2008	8	Togo	101.2%	1970	1974	5
Gabon	250.6%	1970	1980	11	Togo	116.1%	2001	2008	8
Gabon	254.9%	1998	2008	11	Trinidad and Tobago	297.4%	1970	1980	11
Ghana	91.2%	1971	1974	4	Trinidad and Tobago	243.8%	1998	2008	11
Guyana	108.1%	1971	1974	4	Turkmenistan	312.1%	1970	1980	11
Indonesia	103.1%	1972	1974	3	Turkmenistan	205.4%	1998	2008	11
Indonesia	151.7%	1999	2008	10	United Arab Emirates	283.2%	1970	1980	11
Iran	307.5%	1970	1980	11	United Arab Emirates	259.7%	1998	2008	11
Iran	319.0%	1998	2008	11	Uzbekistan	84.3%	2002	2008	7
Iraq	327.9%	1970	1980	11	Venezuela	300.0%	1970	1980	11
Iraq	337.6%	1998	2008	11	Venezuela	306.9%	1998	2008	11
Kazakhstan	220.2%	1970	1980	11	Vietnam	111.7%	1970	1974	5
Kazakhstan	275.8%	1998	2008	11	Vietnam	117.6%	2002	2008	7
Kuwait	316.0%	1970	1980	11	Yemen	313.4%	1970	1980	11
Kuwait	314.3%	1998	2008	11	Yemen	302.1%	1998	2008	11
Kyrgyzstan	113.3%	1970	1974	5	Zambia	193.2%	2002	2011	10

Cumshock: Refers to the cumulative price growth from the beginning to the end of each episode

Table 1: Commodity price boom episodes

Country	Cumshock	Beginning	End	Duration	Country	Cumshock	Beginning	End	Duration
Algeria	-86.6%	1980	1998	19	Libya	-90.5%	1980	1998	19
Angola	-90.8%	1980	1998	19	Mali	-44.2%	1995	1999	5
Armenia	-61.6%	1979	1986	8	Mauritania	-86.4%	1973	2002	30
Armenia	-50.4%	1988	1993	6	Mongolia	-45.7%	1995	1999	5
Australia	-51.2%	1980	1986	7	Mozambique	-48.1%	1979	1982	4
Azerbaijan	-88.5%	1980	1998	19	Mozambique	-51.0%	1988	1993	6
Bahrain	-44.3%	1983	1986	4	Myanmar	-70.4%	1979	2002	24
Benin	-45.4%	1983	1986	4	Namibia	-45.5%	1988	1993	6
Bhutan	-44.9%	1974	1975	2	New Zealand	-48.3%	1979	1985	7
Bhutan	-44.4%	1979	1982	4	Niger	-76.0%	1979	1998	20
Bhutan	-48.3%	1995	2001	7	Nigeria	-90.1%	1980	1998	19
Bolivia	-78.7%	1980	1999	20	Norway	-84.8%	1980	1998	19
Botswana	-85.0%	1974	2003	30	Oman	-88.5%	1980	1998	19
Brunei	-87.0%	1980	1998	19	Qatar	-87.0%	1980	1998	19
Burkina Faso	-87.2%	1974	2002	29	Republic of Congo	-87.5%	1980	1998	19
Burundi	-88.2%	1977	2001	25	Russia	-83.2%	1980	1998	19
Cameroon	-77.7%	1979	1998	20	Saudi Arabia	-90.2%	1980	1998	19
Central African Republic	-59.9%	1979	1985	7	Senegal	-74.3%	1979	2002	24
Chad	-88.3%	1980	1998	19	Sierra Leone	-84.4%	1977	2003	27
Chile	-45.7%	1995	1999	5	Solomon Islands	-58.0%	1977	1985	9
Colombia	-77.0%	1980	1998	19	Sudan	-87.1%	1980	1998	19
Cote d'Ivoire	-46.1%	1979	1982	4	Suriname	-52.1%	1980	1982	3
Dem. Rep. of Congo	-75.9%	1979	2002	24	Suriname	-53.5%	1988	1993	6
Ecuador	-79.8%	1980	1998	19	Syria	-85.4%	1980	1998	19
Equatorial Guinea	-90.3%	1980	1998	19	Tajikistan	-54.3%	1979	1982	4
Ethiopia	-90.5%	1977	2001	25	Tajikistan	-59.0%	1988	1993	6
Gabon	-85.4%	1980	1998	19	Togo	-75.8%	1974	2001	28
Ghana	-84.7%	1977	2000	24	Trinidad and Tobago	-84.2%	1980	1998	19
Guinea	-52.0%	1980	1982	3	Turkmenistan	-85.3%	1980	1998	19
Guinea	-55.0%	1988	1993	6	Uganda	-86.0%	1977	2002	26
Guyana	-77.3%	1980	2002	23	United Arab Emirates	-86.4%	1980	1998	19
Iceland	-50.1%	1973	1975	3	Uruguay	-71.3%	1979	2001	23
Iceland	-72.5%	1988	2002	15	Venezuela	-88.9%	1980	1998	19
Indonesia	-75.1%	1979	1999	21	Vietnam	-75.0%	1980	1998	19
Iran	-89.7%	1980	1998	19	Yemen	-89.4%	1980	1998	19
Iraq	-91.2%	1980	1998	19	Zambia	-87.3%	1974	2002	29
Kazakhstan	-85.3%	1980	1998	19	Zimbabwe	-47.8%	1980	1986	7
Kenya	-75.2%	1977	2002	26	Zimbabwe	-46.4%	1989	1993	5
Kuwait	-89.3%	1980	1998	19					

Cumshock: Refers to the cumulative price growth from the beginning to the end of each episode

Table 2: Commodity price bust episodes

4. Empirical results

4.1. Cointegration analysis

To begin with, table 3 provides some estimates of panel unit root tests on our interest variables using the Maddala and Wu (1999) test and the cross-section dependence robust Pesaran (2007) test. Thanks to dynamic unreported results we have set the number of lags to 2 without a trend for CSCPI and to 1 for our concentration index with a trend.

While the results unanimously fail to reject the unit root hypothesis for ln(CSCPI), the results are mixed for our concentration index. In fact, the Maddala and Wu test (1999) rejects the presence of a unit root test, while the Pesaran test fails to reject the unit root hypothesis on the specification with trend but reject it on the specification without trend. Due to the significance of a trend in the concentration index data process and to the importance of cross-section dependence[35] in our sample we rely on the estimates that fails to reject the hypothesis of a unit root even though it is the only reported result which do so.

Variable	With trend				Without trend			
	Maddala and Wu (1999)		Pesaran (2007)		Maddala and Wu (1999)		Pesaran (2007)	
	Chi^2	P-Value	Zt-bar	P-Value	Chi^2	P-Value	Zt-bar	P-Value
ln(Conc Index)	201.884	0.002	-1.129	0.129	216.822	0.000	-3.145	0.001
ln(CSCPI)	73.408	1.000	1.656	0.951	120.119	0.955	3.196	0.999

***Table 3*: Panel unit root tests**

We now turn our attention to the estimation of the potential cointegration relationship on different country grouping in table 4. For every specification we fail to reject the difference between the coefficients estimated thanks to the MG model and those estimated with the PMG which seems to validate the hypothesis of long-run coefficients homogeneity. Regarding the Westerlund cointegration tests, it is striking to realize that we reject the hypothesis of no cointegration for the whole panel for our main regression as well as with our energy and exhaustible equations. However, we fail to reject the no cointegration hypothesis for the 4 test statistics with the food, raw agricultural materials and mining groupings.

When looking at the PMG estimates, we remark that the speed of adjustment is significantly negative which is the sign of a strong reversion towards the long-run relationship[36]. Moreover, the long run coefficient for the CSCPI variations is always significantly positive apart from the raw agricultural materials estimation. Regarding the short-run impact of CSCPI variations we find a significant positive impact aside from raw agricultural materials and mining regressions, while the lagged variations are only significant twice and have an impact from two to three times weaker on the concentration index. As a result, we won't introduce lagged variations of CSCPI in the analysis and will keep on with the contemporaneous variation. We could also note that only for the energy category the short run coefficient exceeds the long run coefficient but this point necessitates further analysis in order to deduce something consistent about it.

To sum up, commodity dependent countries have experienced both a short-run and a long-run relationship which leads to a concentration of exports following a commodity price increase or a diversification of exports following a

[35] We have performed some unreported Pesaran (2004) tests which strongly reject the hypothesis of cross-section independence in our panel.

[36] The speed of adjustment -0.223 in the main specification corresponds to a duration of 2.75 years in order to eliminate 50% of an exogenous shock (often referred as the half-life) and 5.49 years in order to eliminate 75%.

commodity price drop. However, as evidenced by our results this effect may be triggered by producers of exhaustible resources, especially hydrocarbon producers.

	(1) Main	(2) Food	(3) Rawagri	(4) Mining	(5) Energy	(6) Exhaustible
LR						
ln(CSCPI)	0.063***	0.098***	-0.062	0.117***	0.041***	0.052***
	(7.796)	(7.454)	(-1.408)	(6.430)	(4.785)	(6.073)
SR						
EC_{t-1}	-0.223***	-0.266***	-0.298***	-0.272***	-0.219***	-0.228***
	(-9.981)	(-6.280)	(-7.034)	(-6.071)	(-6.161)	(-8.320)
$\Delta ln(CSCPI)_t$	0.049***	0.043**	-0.006	0.014	0.063***	0.048***
	(4.806)	(2.243)	(-0.232)	(0.562)	(6.240)	(4.203)
$\Delta ln(CSCPI)_{t-1}$	-0.008	-0.022**	-0.022	-0.039	0.020***	0.002
	(-0.775)	(-2.011)	(-1.001)	(-1.432)	(2.988)	(0.161)
Constant	0.250***	0.217***	0.527***	0.234***	0.294***	0.287***
	(9.058)	(4.849)	(6.580)	(5.312)	(6.055)	(7.916)
N	2692	797	213	777	1316	1976
N of countries	74	21	6	21	36	54
Hausman (P-Value)	0.346	0.337	1.000	0.186	0.174	0.598
Westerlund Gt stat (P-Value)	0.071	0.104	0.627	0.455	0.009	0.045
Westerlund Ga stat (P-Value)	0.806	0.681	0.840	0.915	0.236	0.664
Westerlund Pt stat (P-Value)	0.000	0.252	0.177	0.143	0.000	0.000
Westerlund Pa stat (P-Value)	0.001	0.235	0.304	0.261	0.000	0.001
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01						

EC_{t-1}: Error correction term
Hausman (P-Value): P-Value for the Hausman test of the non-systematic difference between the coefficients for the MG and PMG estimates.
The upper part of the table refers to the long-run relationship (LR) while the bottom part refers to the short run coefficients (SR).

Table 4: Pool Mean Group (PMG) estimations

4.2. Common correlated effects estimators

4.2.1. Main estimations

While the previous section has evidenced a positive relationship between commodity price variations and export concentration both in the short run and in the long run, this model fails to take into account the global common factors impacting differently every country through both dependent and independent variables of our model, which motivates the analysis of our CCEMG results.

In table 5.1, we find a strongly significant positive and stable impact of CSCPI variations on the evolution of our export concentration index across every specification. The average coefficient of 0.118 across our 7 columns show that a 10% increase in commodity prices is associated to a slightly more than 1% increase in export concentration[37]. Even though this quantitative impact may seem low, we should remind that it corresponds only to the contemporaneous response to commodity price variations. The analysis of commodity price booms and busts episodes in next section will take into account longer-run effects on diversification. We should also note that REER appreciation and a decrease in the GFCF share are also slightly linked with export concentration.

The pattern is quite identical regarding estimates based on the intensive margin index in table 5.2 but with a more salient impact of REER appreciations. However, in table 5.3 CSCPI variations only impact the extensive margin index

[37] The interpretation could also be reversed with a 10% decrease in commodity prices being associated with a slightly more than 1% decrease in export concentration (or increase in export diversification).

when the financial development is included in the regression, while improvements in the stock of human capital seem to be the main determinants of extensive diversification, that is to say the creation of new exports lines.

Finally, our model fails to explain correctly the variations of the relative quality of exported goods in table 5.4 as well as the evolution of the manufacturing value-added share in table 5.5, even though we find some consistent impact of REER depreciation on manufacturing value-added share growth.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Conc index)						
Δln(CSCPI)	0.127***	0.127***	0.113***	0.119***	0.089***	0.114***	0.138***
	(5.333)	(5.999)	(5.322)	(4.026)	(3.887)	(4.651)	(5.624)
Δln(REER)	0.030**	0.019	0.028*	0.040**	0.021	0.016	0.039**
	(2.272)	(1.338)	(1.927)	(2.142)	(1.365)	(1.144)	(2.221)
ln(GFCFshare)	-0.013*	-0.013*	-0.010	-0.017**	-0.003	-0.011	-0.005
	(-1.900)	(-1.693)	(-1.088)	(-2.064)	(-0.362)	(-1.181)	(-0.695)
ln(School)	-0.018	-0.020	-0.033**	-0.028	-0.024	0.003	-0.020
	(-1.633)	(-1.136)	(-2.123)	(-1.337)	(-1.381)	(0.187)	(-1.275)
vol(CSCPI)	-0.003						
	(-1.442)						
ln(Pop active)		0.009					
		(0.228)					
$\ln(\frac{M}{GDP})$			-0.020*				
			(-1.718)				
ln(Financial dev)				0.003			
				(0.368)			
Capital open					0.012		
					(0.822)		
Democracy level						-0.017	
						(-1.339)	
ln(PPP GDP pc)							0.038**
							(2.037)
N	2386	2383	2386	2009	2190	2310	2272
N of countries	72	72	72	70	72	71	72
Wald Chi²	41.958	41.980	40.676	26.980	19.685	26.168	42.822
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Table 5.a: Mean-Group Common-correlated effects (CCEMG) estimates for the concentration index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Int margin)						
Δln(CSCPI)	0.089***	0.116***	0.102***	0.122***	0.098***	0.114***	0.117***
	(3.553)	(4.706)	(4.530)	(4.300)	(4.391)	(4.549)	(4.250)
Δln(REER)	0.053***	0.031*	0.047**	0.054***	0.017	0.023	0.035**
	(3.309)	(1.798)	(2.510)	(2.960)	(0.979)	(1.329)	(2.114)
ln(GFCFshare)	-0.014*	-0.012	-0.018	-0.016	-0.006	-0.011	-0.011
	(-1.950)	(-1.515)	(-1.442)	(-1.638)	(-0.676)	(-1.042)	(-1.382)
ln(School)	0.019	0.031	0.040*	-0.028	-0.002	0.033*	0.012
	(1.178)	(1.229)	(1.932)	(-1.088)	(-0.092)	(1.813)	(0.639)
vol(CSCPI)	-0.005*						
	(-1.733)						
ln(Pop active)		0.122**					
		(2.365)					
$\ln(\frac{M}{GDP})$			-0.013				
			(-0.771)				
ln(Financial dev)				0.001			
				(0.149)			
Capital open					0.029		
					(1.092)		
Democracy level						-0.017	
						(-1.166)	
ln(PPP GDP pc)							0.023
							(0.980)
N	2386	2383	2386	2009	2190	2310	2272
N of countries	72	72	72	70	72	71	72
Wald Chi²	31.766	34.782	33.229	31.141	21.892	28.189	25.812
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

<u>Table 5.b</u>: Mean-Group Common-correlated effects (CCEMG) estimates for the intensive margin index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Ext margin)						
Δln(CSCPI)	0.100	0.042	0.034	0.260***	0.043	0.034	0.078
	(1.291)	(0.411)	(0.400)	(3.683)	(0.601)	(0.470)	(0.873)
Δln(REER)	-0.062	-0.089*	-0.044	-0.073	-0.058	-0.087*	-0.058
	(-1.098)	(-1.709)	(-0.867)	(-1.311)	(-0.937)	(-1.774)	(-1.186)
ln(GFCFshare)	0.020	0.030	-0.018	-0.042	-0.024	-0.007	0.014
	(0.443)	(0.704)	(-0.424)	(-0.846)	(-0.722)	(-0.133)	(0.440)
ln(School)	-0.163**	-0.150**	-0.163**	-0.177*	-0.114**	-0.248***	-0.087
	(-2.304)	(-2.099)	(-2.258)	(-1.793)	(-2.378)	(-3.158)	(-1.344)
vol(CSCPI)	-0.019						
	(-1.374)						
ln(Pop active)		-0.416*					
		(-1.748)					
$\ln(\frac{M}{GDP})$			-0.039				
			(-0.620)				
ln(Financial dev)				-0.002			
				(-0.062)			
Capital open					0.045		
					(0.736)		
Democracy level						-0.062	
						(-0.949)	
ln(PPP GDP pc)							0.014
							(0.098)
N	2317	2314	2317	1965	2135	2244	2210
N of countries	72	72	72	69	72	71	72
Wald Chi²	10.267	11.049	6.573	19.217	7.957	14.262	4.178
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Table 5.c: Mean-Group Common-correlated effects (CCEMG) estimates for the extensive margin index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Quality index)						
Δln(CSCPI)	-0.037*	-0.031	-0.004	-0.019	-0.029	-0.007	-0.013
	(-1.927)	(-1.354)	(-0.184)	(-0.764)	(-1.224)	(-0.321)	(-0.539)
Δln(REER)	-0.020	-0.011	-0.018	-0.012	-0.022	-0.013	-0.007
	(-1.361)	(-0.631)	(-1.256)	(-0.575)	(-1.209)	(-0.896)	(-0.497)
ln(GFCFshare)	0.011*	0.011	0.016	0.016	0.004	0.025***	0.007
	(1.785)	(1.403)	(1.579)	(1.487)	(0.343)	(2.779)	(0.884)
ln(School)	-0.008	0.014	-0.001	0.002	0.005	-0.009	0.015
	(-0.622)	(0.956)	(-0.080)	(0.079)	(0.246)	(-0.587)	(0.958)
vol(CSCPI)	0.005*						
	(1.655)						
ln(Pop active)		-0.036					
		(-0.741)					
$\ln(\frac{M}{GDP})$			0.013				
			(1.197)				
ln(Financial dev)				-0.007			
				(-0.727)			
Capital open					0.004		
					(0.207)		
Democracy level						0.021	
						(1.134)	
ln(PPP GDP pc)							-0.005
							(-0.201)
N	2279	2276	2279	1909	2106	2204	2192
N of countries	72	72	72	70	72	71	72
Wald Chi²	11.874	5.660	5.544	3.661	3.179	10.256	2.277
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Table 5.d: Mean-Group Common-correlated effects (CCEMG) estimates for the relative quality index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Manu share)						
Δln(CSCPI)	-0.024	-0.023	-0.040	-0.039	-0.048	-0.024	-0.039
	(-0.826)	(-0.689)	(-1.229)	(-0.977)	(-1.307)	(-0.744)	(-1.038)
Δln(REER)	-0.060*	-0.068*	-0.040	-0.062	-0.077*	-0.034	-0.101**
	(-1.751)	(-1.789)	(-1.244)	(-1.176)	(-1.660)	(-0.915)	(-2.552)
ln(GFCFshare)	-0.009	0.010	-0.019	-0.043*	-0.037	-0.005	0.001
	(-0.485)	(0.512)	(-0.693)	(-1.839)	(-1.617)	(-0.237)	(0.048)
ln(School)	0.011	0.059*	-0.004	-0.003	0.026	0.014	0.014
	(0.352)	(1.687)	(-0.111)	(-0.086)	(0.662)	(0.401)	(0.397)
vol(CSCPI)	-0.002						
	(-0.324)						
ln(Pop active)		0.016					
		(0.188)					
$\ln(\frac{M}{GDP})$			0.045*				
			(1.651)				
ln(Financial dev)				0.030**			
				(2.020)			
Capital open					0.003		
					(0.074)		
Democracy level						-0.050*	
						(-1.742)	
ln(PPP GDP pc)							0.012
							(0.300)
N	2601	2598	2601	2160	2327	2476	2461
N of countries	76	76	76	75	75	74	76
Wald Chi²	4.212	6.818	6.276	9.805	7.525	4.642	7.842
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Table 5.e: Mean-Group Common-correlated effects (CCEMG) estimates for the manufacturing VA share

4.2.2. Robustness checks

In this section, we provide some robustness checks for our main specification.

We try to enter every dependent variable in diff-log form to be sure we are catching a within-country variation of our variables (Appendix 6). Then we test the inclusion of the lagged log version of our dependent variable among our determinants to assess the sensitivity to a dynamic specification (Appendix 7). Even though the lagged term is highly significant our CSCPI coefficients are still strongly significant even though the quantitative impact is slightly reduced. While promising, this specification suffers from the traditional endogeneity problem arising when a lagged dependent variable is included with the dependent variables because it becomes correlated with the residuals. One possibility would be to use a Difference or System-GMM estimator which is often used in those cases to tackle the endogeneity trouble but it can be problematic to find relevant instruments when the time dimension of our panel becomes relatively high and the cross-section dimension relatively low. Moreover, our empirical panel warrants the necessity to tackle the parameter heterogeneity as well as the cross-section dependence, which guards us from using it. An alternative could have been to use 5-year averages often used to get rid of cyclical variations, but our aim is exactly to assess the impact of short-run disturbances, namely commodity price variations so it cannot be a solution. Being aware of the endogeneity trouble in this regression, it seems useful as a sensitivity analysis to check the stability and significance of our coefficients.

We then provide sensitivity to the country selection of our sample. We remove countries whose average population over our time period is below 1 million which removes 8 countries[38] (Appendix 8). To stress the exogeneity of our CSCPI shocks, we remove from our sample current OPEC countries[39] apart from Angola which joined in 2007, and add former member Gabon (Appendix 9). Our last robustness check consists in estimating our main specification using REER indices computed thanks to the WEO GDP deflator and the WEO CPI instead of the PWT 8.0 GDP deflator (Appendix 10).

It appears that none of these estimations call into question our previous results regarding the impact of commodity price variations on our diversification indicators. Commodity price variations have induced an export concentration through the intensive margin that is to say through a decrease in the balance of already existing activities. However, estimates on the extensive margin, the relative quality index or the manufacturing share are weak to no significant.

4.3. Analysis of commodity price booms and busts episodes

While our econometric specifications have been illustrative of the role of commodity price variations in explaining diversification patterns, we may remind that our previous results have been computed on the whole sample. On top of that we have mostly focused on the contemporaneous impact of commodity price variations on diversification outcomes. However, these fluctuations could also impact the diversification pattern in the longer run as shown by the PMG estimates in section 4.1.

Based on the commodity price booms and busts identified in section 3.3; we present in this section the evolution of our diversification indicators during these periods[40]. The point of this section is not to provide a true causal relationship from commodity price variations to trade diversification ruling out the evolution of other determinants over time. Instead, we have computed and tested the difference between the end and beginning of the period log forms of our diversification indices.

It would have been better to compare years before the boom with years after the boom but our time sample limit this possibility because we miss numerous pre-boom observations for the 1970s commodity price booms as well as post-boom observations for the 2000s booms. As a results, assessing the evolution of our indicators between the beginning and the end of these episodes provide a relevant second-best option.

[38] Iceland, Guyana, Suriname, Bahrain, Qatar, Bhutan, Equatorial Guinea, Solomon Islands.
[39] These countries are Algeria, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.
[40] Computations for boom episodes ending in 2011 have been computed until 2010 regarding the 3 indices of diversification and the relative quality index because of data unavailability.

We will also provide some analysis comparing the evolution of export diversification during 1970s and 2000s commodity price booms.

Boom episodes				Bust episodes			
Variable	Diff.	P-Value	N	Variable	Diff.	P-Value	N
ln(conc index)	0.093***	0.000	85	ln(conc index)	-0.121***	0.000	62
ln(int margin)	0.138***	0.000	85	ln(int margin)	-0.056*	0.057	62
ln(ext margin)	-0.208**	0.028	81	ln(ext margin)	-0.402***	0.001	60
ln(quality index)	-0.041*	0.059	78	ln(quality index)	-0.039	0.160	55
ln(manu share)	-0.147***	0.001	87	ln(manu share)	0.034	0.640	67
ln(CSCPI)	1.377***	0.000	94	ln(CSCPI)	-1.201***	0.000	77
ln(REER)	0.348***	0.000	88	ln(REER)	-0.329***	0.000	67
ln(GFCF share)	0.088*	0.056	87	ln(GFCF share)	0.056	0.457	67
ln(school)	0.297***	0.000	72	ln(school)	0.506***	0.000	61
vol(CSCPI)	2.194***	0.000	94	vol(CSCPI)	-0.315	0.244	77
ln(pop active)	0.121***	0.000	94	ln(pop active)	0.265***	0.000	77
ln(M/GDP)	0.023	0.597	87	ln(M/GDP)	0.212***	0.002	67
ln(financial dev)	1.149***	0.000	66	ln(financial dev)	-0.550**	0.016	45
capital open	0.037	0.115	78	capital open	0.098**	0.018	57
democracy	0.045**	0.047	80	democracy	0.139***	0.000	62
ln(GDP PPP pc)	0.550***	0.000	84	ln(GDP PPP pc)	0.558***	0.000	61

Table 6: Test for the non-significance of the difference between the end and beginning of the period outputs

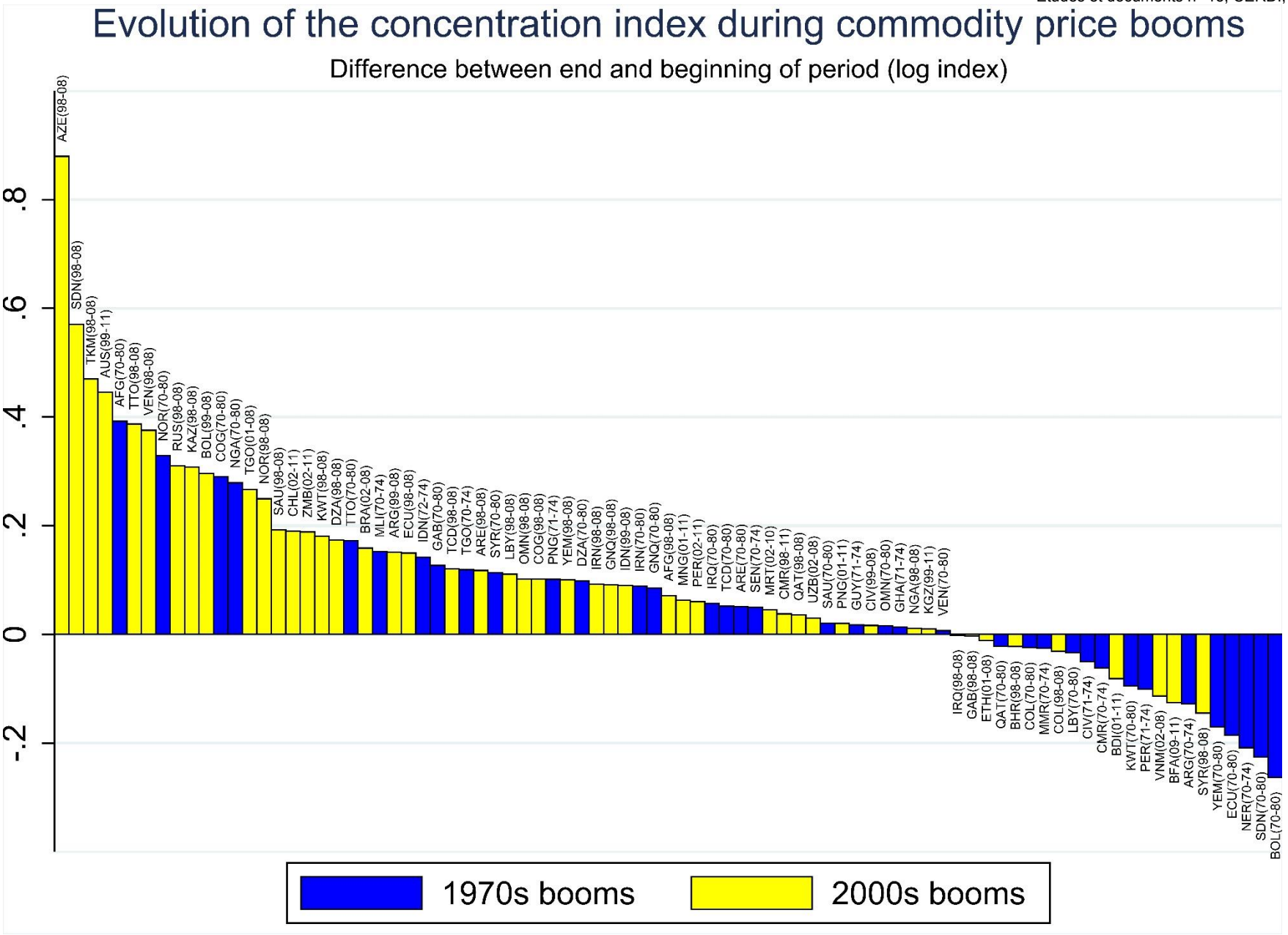
4.3.1. Commodity price booms

First, we depict the evolution of diversification outcomes between the end and the beginning of the selected boom episodes. In line with our previous results, graph 2.a. and 2.b. confirm that commodity price booms have increased export concentration during most episodes (62/85) especially through an increase in the intensive margin index (64/85). While the pattern regarding the extensive margin component in graph 2.c. seems to lean towards a decrease over time, it is dominated by few episodes of strong decrease but is mixed when having a deeper look with mostly as many episodes linked to a decrease (46/81) or an increase of the extensive margin component[41]. The pattern is also mixed regarding the relative quality index in graph 2.d. with only a slight majority of commodity price boom episodes related to a decrease in the exported goods quality (43/78). In accordance to the Dutch disease literature, almost two third (56/87) of the boom episodes represented in graph 2.e. have shrunk the size of the manufacturing sector.

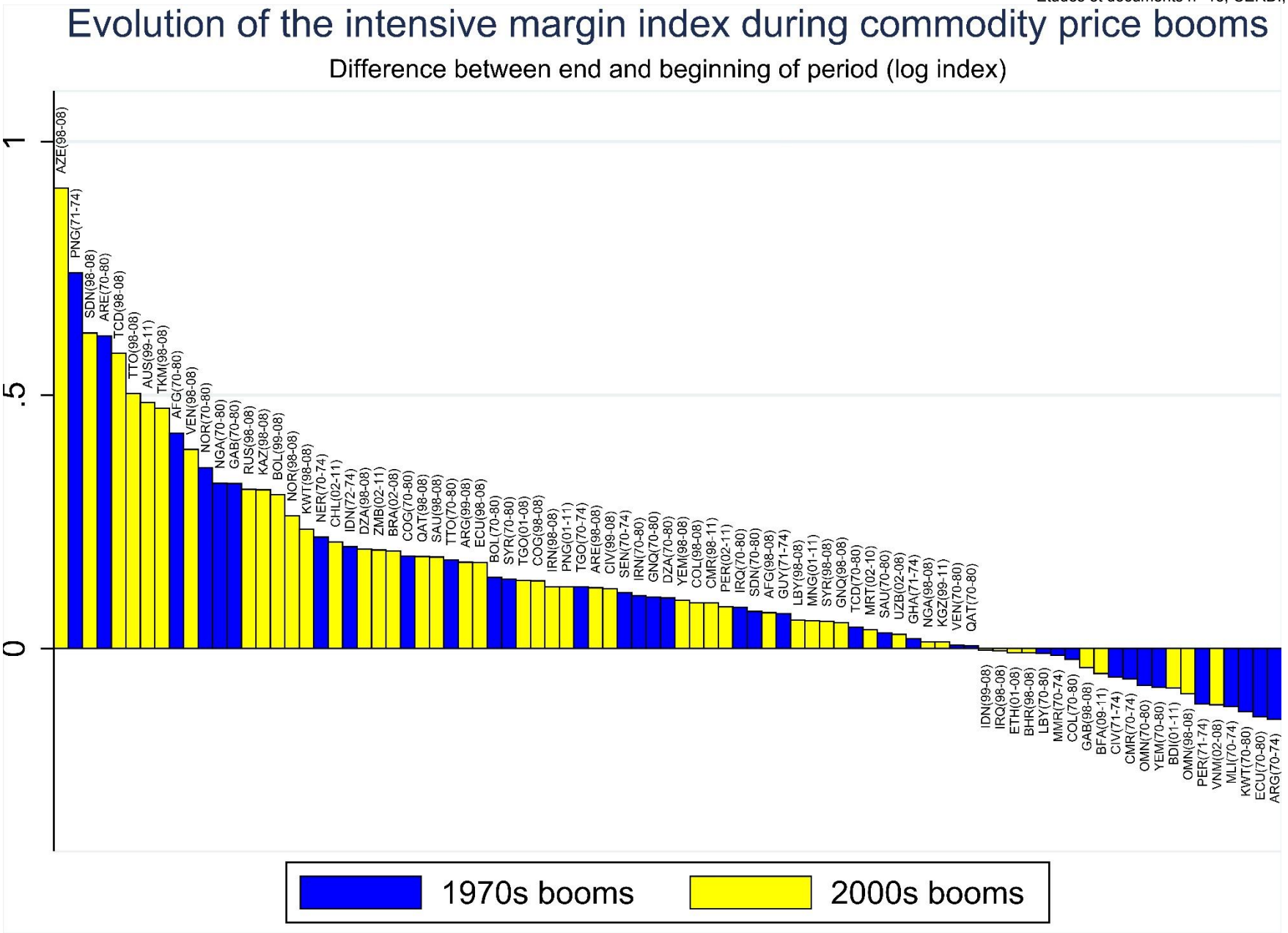
To complement this first analysis, we have provided in table 6 the results for testing the non-significance of the difference between the end and beginning of the period for each output. The results show a highly significant 9.3% increase of export concentration especially through the intensive margin during booms as well as a highly significant 14.7% decrease of the manufacturing value added share. While the 20.6% decrease of the extensive margin component could seem substantial the dominance of outliers in the pattern evidenced previously prevent us from emphasizing this result so much. Finally, the relative quality index slightly decreased but this result is only significant at the 10% margin.

Those results are especially concerning because it evidences the failure from both governments having faced commodity price booms as well as from the private sector as a whole to trigger export diversification. At best the relative quality of their exported goods have not improved despite the commodity windfall and the manufacturing sector has decreased in size certainly through the traditional Dutch disease mechanism. While these concerns may not have been so problematic during those boom episodes they may have penalized the economy during the subsequent commodity price reversal.

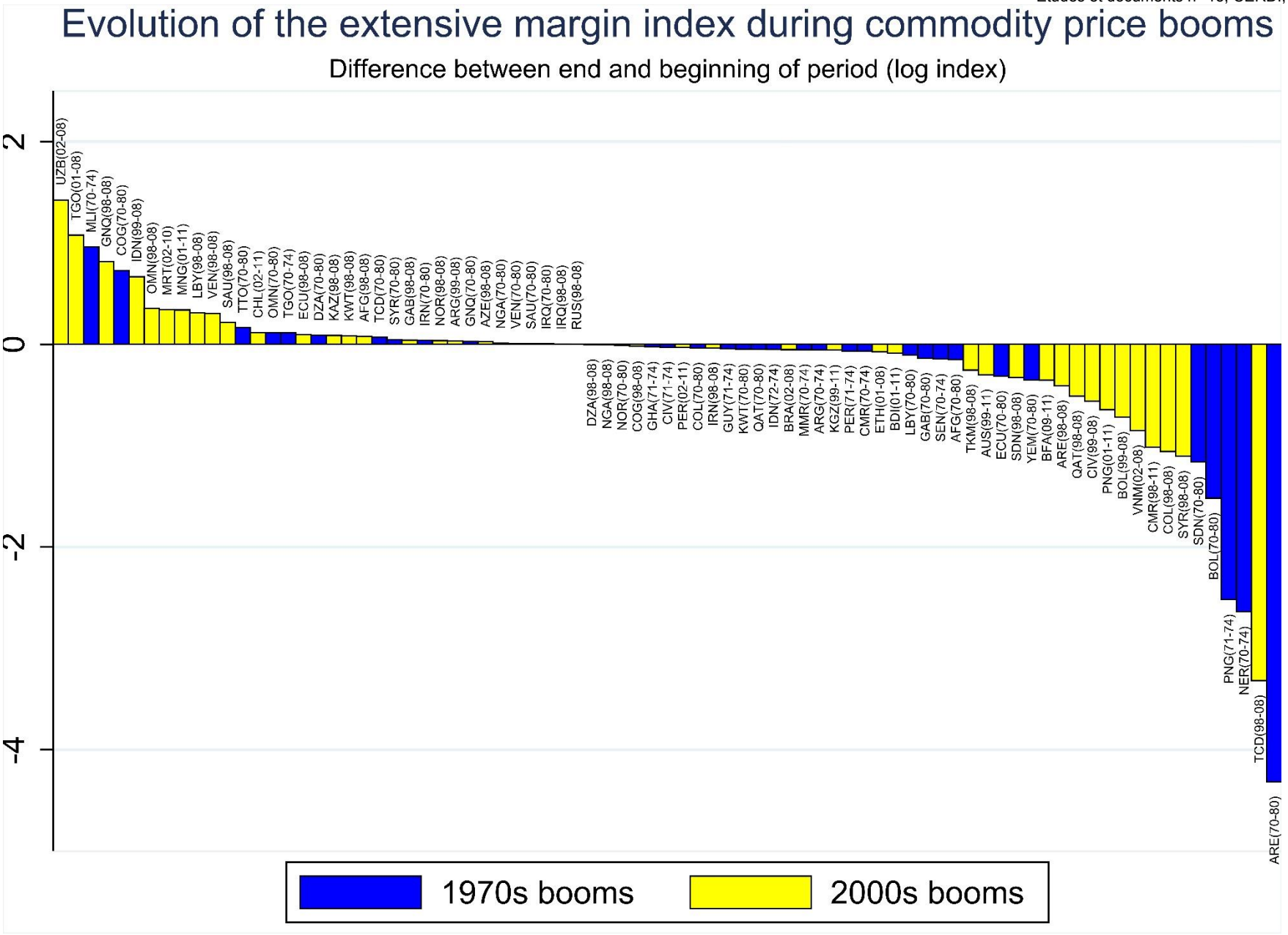
[41] This illustrates the need to weight for outliers we have tackled in our main CCEMG specifications.



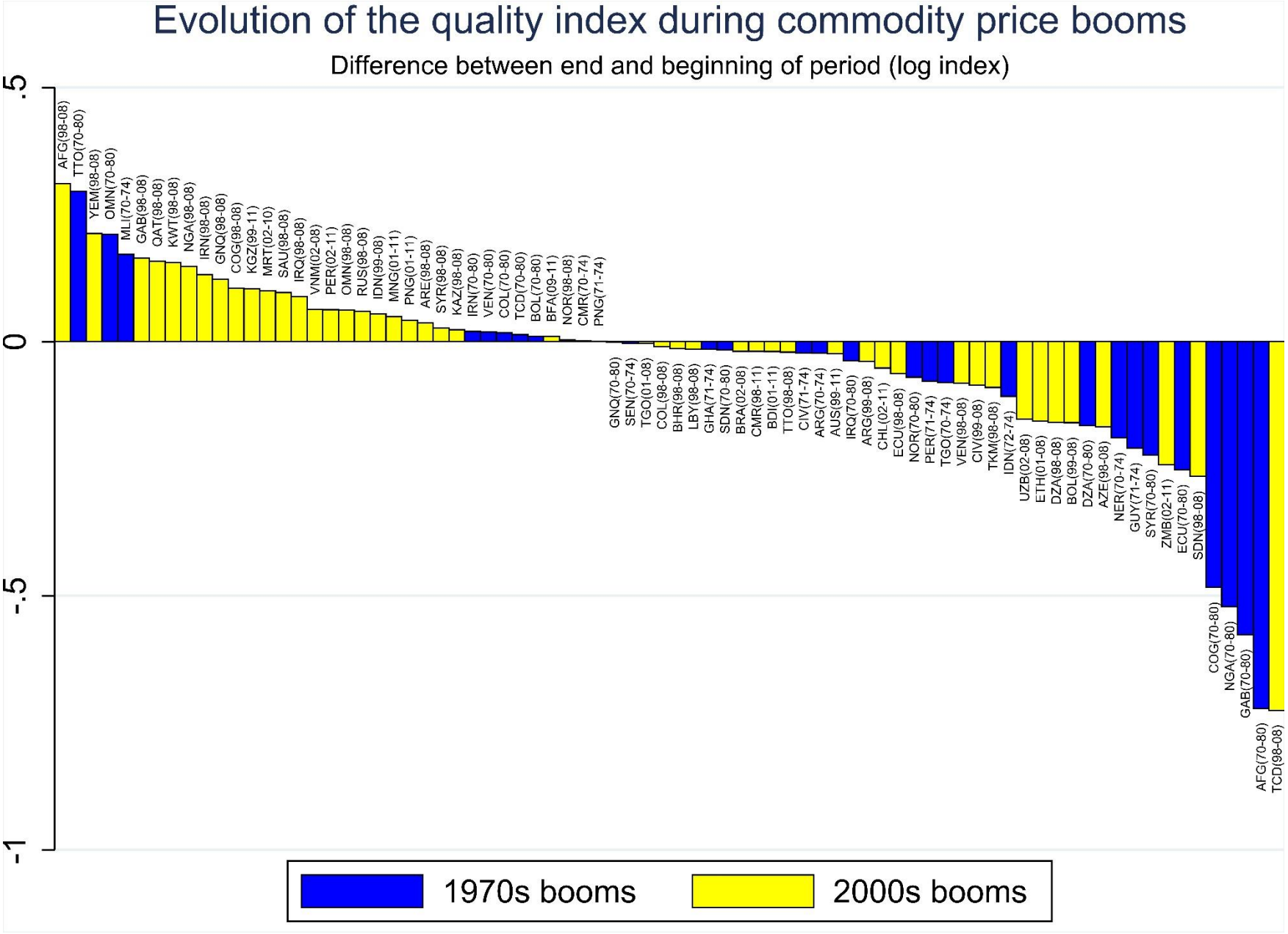
***Graph 2.a*: Evolution of the concentration index during commodity price booms**



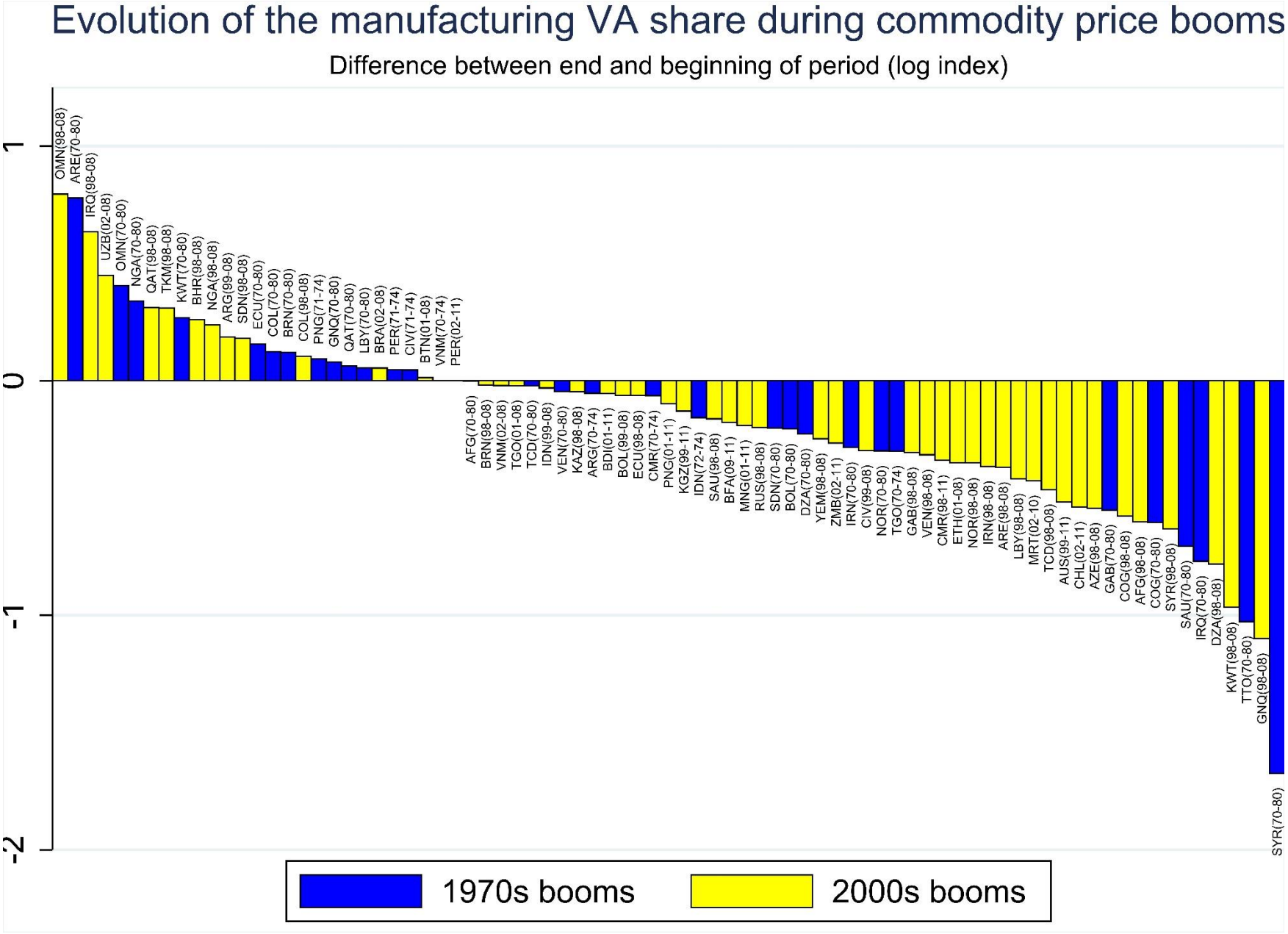
***Graph 2.b*: Evolution of the intensive margin index during commodity price booms**



***Graph 2.c*: Evolution of the extensive margin index during commodity price booms**



***Graph 2.d*: Evolution of the relative quality index during commodity price booms**



<u>Graph 2.e</u>: Evolution of the manufacturing VA share during commodity price booms

4.3.2. Comparison between the commodity price booms of the 1970s and the 2000s

Unlike our commodity bust episodes, almost half of our commodity price boom episodes occurred during the 1970s and the remaining half during the 2000s which represent two periods of overall commodity price booms. We benefit from this looking at the evolution of the diversification pattern during each boom in table 7.

Surprisingly the export concentration index has only significantly increased for episodes in the 2000s with a 14% increase against a non-significant 3.2% increase in the 1970s, while the result remains significant in both cases regarding the intensive margin index. In fact, we may have expected a sounder macroeconomic management during the most recent year as well as a greater care for the diversification agenda in resource-dependent countries. It is tempting to draw a parallel with the current difficulty of countries like Venezuela to recover despite having failed to diversify when the money was coming. Some external factors could also explain this pattern: the more competitive trade environment in the 2000s than in the 1970s, the openness and currency undervaluation of East Asian economies including China in the 2000s, or the decrease in trade barriers over time which may have complicated the arrival of newcomers[42].

We find a similar result as before concerning the extensive margin index evolution during the 1970s with a strong but only partly significant decrease dominated by some outliers while the decrease has been weaker and no significant for episodes in the 2000s. This result goes in the same direction giving some indication of fewer new exported products during the 2000s than in the 1970s.

Regarding the decrease in the relative quality index it has only been significant for episodes in the 1970s. Even though the quality did not improve during the last boom, the decrease of the relative quality did not occur like in the 1970s. However, the fact that the manufacturing sector size was significantly reduced (and more strongly) during the 2000s and not in the 1970s is also worrying for the current low commodity price era those countries are facing.

While some may point out that the mean commodity price boom has been 16.5 percentage point higher for the 1970s episodes it doesn't represent a so big difference in comparison with the respective 146.5% and 130% mean commodity price increases. On top of that with 30 more years of experiences in economics management such a difference in commodity price shock can be hardly seen or even shouldn't explain the weaker performance in the 2000s regarding the diversification and structural transformation indicators.

Despite the small size of our sample and as a result the poor quality of our statistical tests we provide in table 8 the results of the non-significance test of the difference between the evolution of one indicator in the 2000s and the evolution of the same indicator in the 1970s restricting our sample to countries having faced both booms. The results fail to provide any significant difference for the evolution of our diversification indicators during both booms even though we find a stronger increase of the overall concentration index at the 10% margin.

If we can see some signs of a less pessimistic pattern for the 2000s episodes than previously we should not forget the decrease in the quality of the test due to the decrease in the sample size. Moreover, restricting our sample to countries having already faced a comparable boom episode in the 1970s we could have expected a better diversification performance during the 2000s which apparently at best has not been the case

[42] I leave the identification of the right explanation to further research.

Booms 1970s				Booms 2000s			
Variable	Diff.	P-Value	N	Variable	Diff.	P-Value	N
ln(conc index)	0.032	0.207	37	ln(conc index)	0.140***	0.000	48
ln(int margin)	0.102***	0.004	37	ln(int margin)	0.166***	0.000	48
ln(ext margin)	-0.311*	0.059	37	ln(ext margin)	-0.122	0.260	44
ln(quality index)	-0.101**	0.020	30	ln(quality index)	-0.004	0.861	48
ln(manu share)	-0.114	0.110	38	ln(manu share)	-0.174***	0.002	49
ln(CSCPI)	1.465***	0.000	44	ln(CSCPI)	1.300***	0.000	50
ln(REER)	0.349***	0.000	38	ln(REER)	0.348***	0.000	50
ln(GFCF share)	0.085	0.140	38	ln(GFCF share)	0.090	0.193	49
ln(school)	0.353***	0.000	34	ln(school)	0.246***	0.000	38
vol(CSCPI)	2.267***	0.000	44	vol(CSCPI)	2.130***	0.000	50
ln(pop active)	0.206***	0.000	44	ln(pop active)	0.046*	0.080	50
ln(M/GDP)	0.075	0.243	38	ln(M/GDP)	-0.018	0.758	49
ln(financial dev)	0.950***	0.000	24	ln(financial dev)	1.262***	0.000	42
capital open	0.047	0.119	31	capital open	0.030	0.372	47
democracy	0.056	0.204	32	democracy	0.038	0.121	48
ln(GDP PPP pc)	0.568***	0.000	35	ln(GDP PPP pc)	0.537***	0.000	49

Table 7: Test for the non-significance of the difference between the end and beginning of the period outputs during each commodity price boom

Booms 2000s - Booms 1970s					
Variable	Diff 2000s	Diff 1970s	Diff 2000s-Diff 1970s	P-Value	N
ln(conc index)	0.129	0.038	0.091**	0.041	31
ln(int margin)	0.162	0.112	0.049	0.337	31
ln(ext margin)	-0.195	-0.323	0.128	0.559	29
ln(quality index)	-0.012	-0.112	0.099	0.182	25
ln(manu share)	-0.191	-0.116	-0.075	0.464	31
ln(CSCPI)	1.384	1.571	-0.187***	0.000	38
ln(REER)	0.409	0.422	-0.013	0.911	32
ln(GFCF share)	0.047	0.065	-0.018	0.858	31
ln(school)	0.258	0.337	-0.079	0.322	22
vol(CSCPI)	2.332	1.669	0.663	0.155	38
ln(pop active)	0.046	0.226	-0.180***	0.000	38
ln(M/GDP)	-0.049	0.050	-0.099	0.217	31
ln(financial dev)	0.634	1.115	-0.481**	0.021	17
capital open	0.004	0.030	-0.026	0.693	23
democracy	0.004	0.092	-0.088	0.162	25
ln(GDP PPP pc)	0.501	0.640	-0.138*	0.074	30

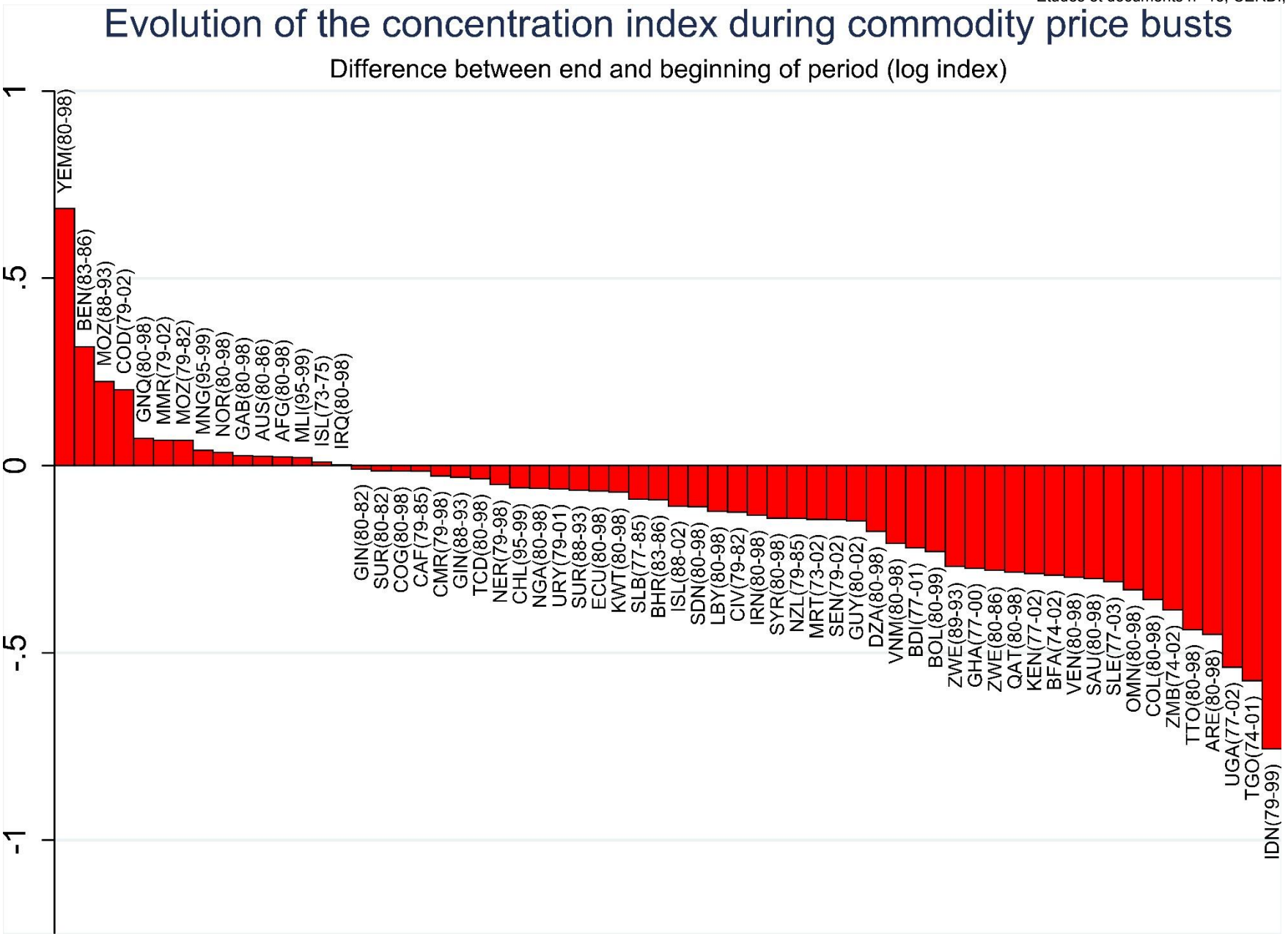
Table 8: Test for the non-significance of the difference between each boom output evolution for countries having experienced 2 major commodity price booms

4.3.3. Commodity price busts

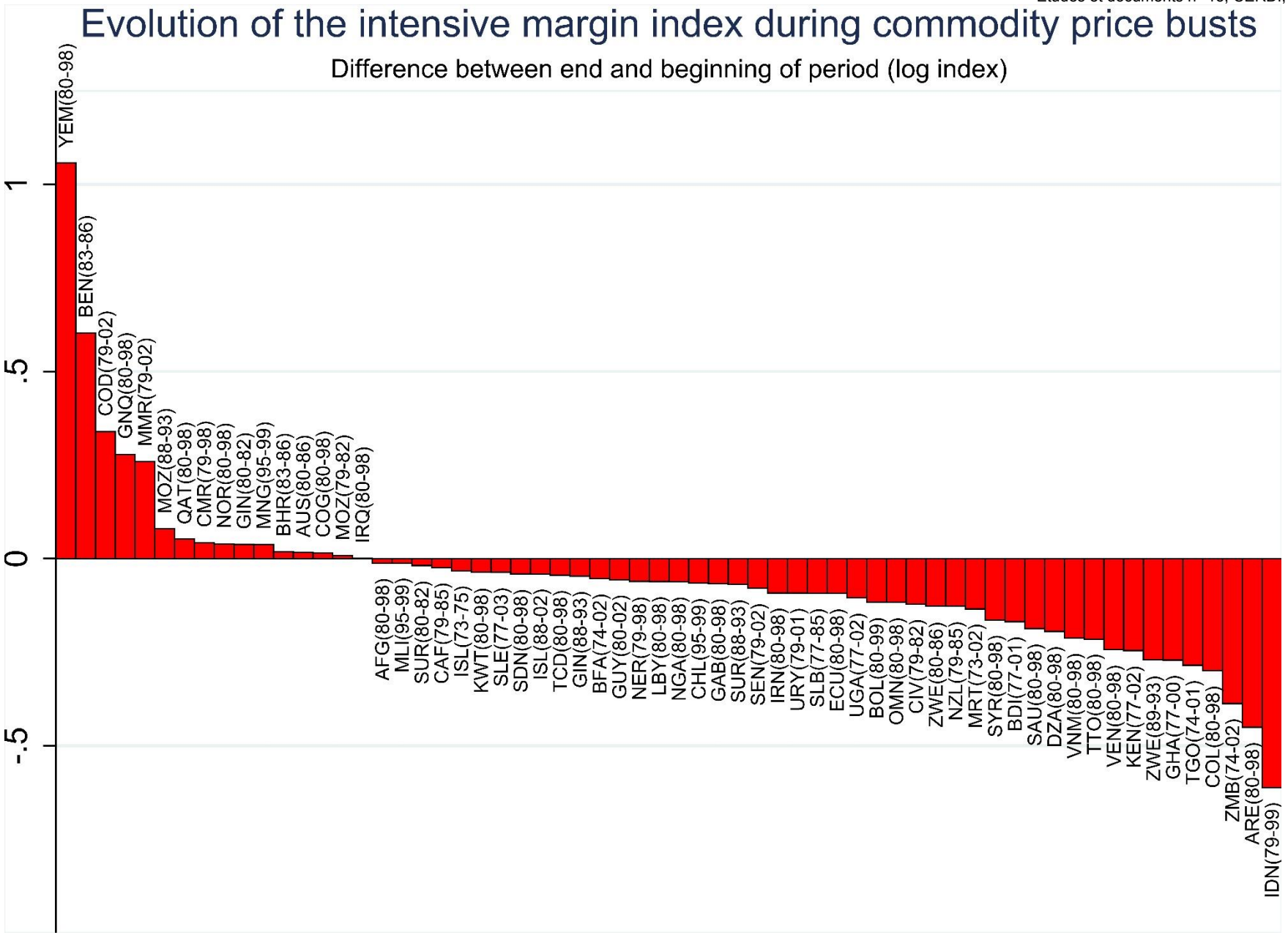
We now turn our attention to the evolution of our diversification outcomes during bust episodes. Graph 3.a. and 3.b. evidence a decrease of the concentration index for nearly three quarters of our episodes (47/62) especially through a decrease of the intensive margin index (46/62). It confirms the previously uncovered result of an increase in export diversification during commodity price drops. More interesting, the pattern also holds for the extensive margin component in graph 3.c. so that almost three quarters of our busts episodes have seen a decrease of the extensive margin index (44/60). While the pattern is less striking, a majority of commodity price busts episodes has induced a decrease of the relative quality index (34/55) in graph 3.d. The pattern is mixed for the manufacturing value added share with only a slight majority of our bust episodes in graph 3.e. having been followed by a decrease in the manufacturing sector size (38/67).

Like for the commodity price booms analysis, we have performed some tests for the non-significance of the difference between our end of the period and beginning of the period outcomes in table 6. The results confirm the graphical pattern with a highly significant 12.1% decrease of our concentration index during commodity price busts. Even though the intensive margin index decreases, its magnitude is weak and is only significant at the 10% level. However, the extensive margin index has strongly and significantly decreased from 40.2% which is both a stronger and more significant result than the one obtained for commodity price booms. Even though the number of recorded exported products may have increased over time due to reasons unrelated to the diversification, it illustrates a higher direction toward export diversification during commodity price drops than during commodity price booms. Besides, both the relative quality index and the manufacturing share have not significantly evolved during these bust episodes.

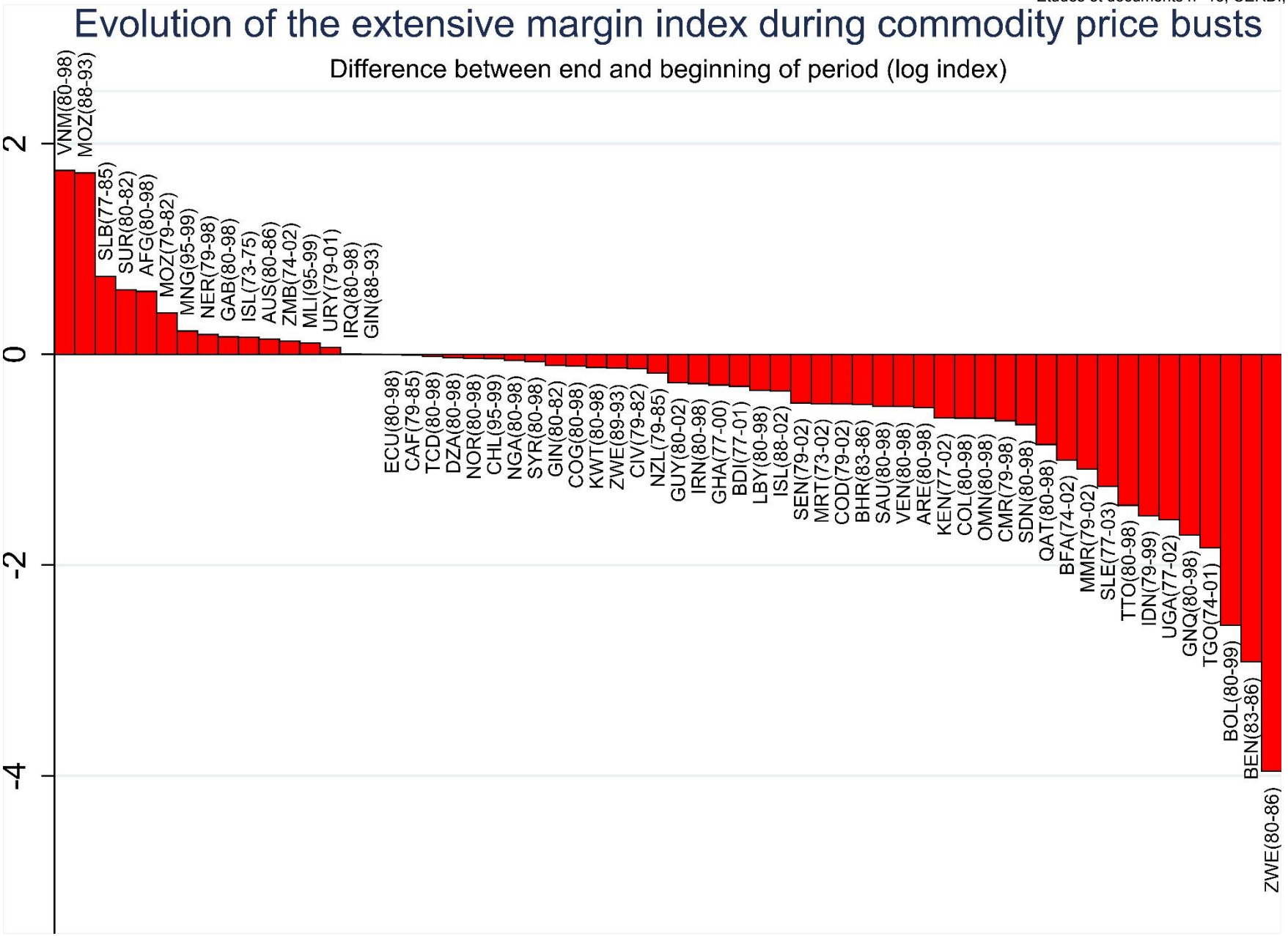
These results confirm the increase in export diversification during commodity price busts which put in perspective with the increase in export concentration during commodity price booms gives us a pattern consistent with what we observed in graph 1.a. It also provides an explanation for the positive and significant impact of commodity price variations on export concentration evidenced previously. While the relative quality of exported products has not significantly been impacted by commodity price busts, the manufacturing sector doesn't significantly increase in relative size despite the decrease in value of the natural resource value added following the commodity price decrease. Whether countries managed to diversify their economy both through a rebalancing of already exported goods and through the arrival of new exported products, it has not significantly increased the relative manufacturing value added share. It could either be illustrative of new activities with a small value added importance in the economy or of the development of non-manufacturing goods exports (mostly commodities), even though the former option is more likely.



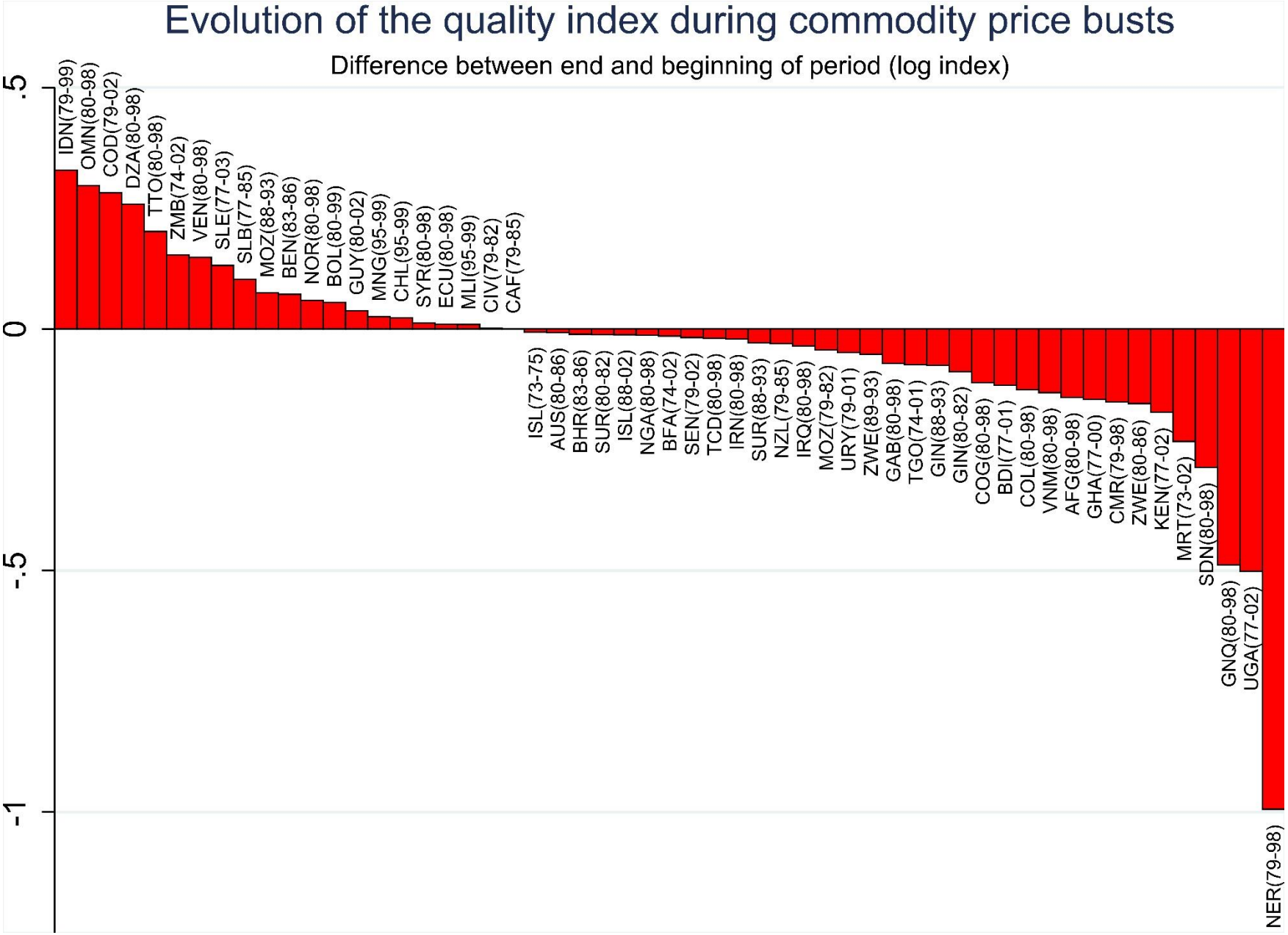
<u>Graph 3.a</u>: Evolution of the concentration index during commodity price busts



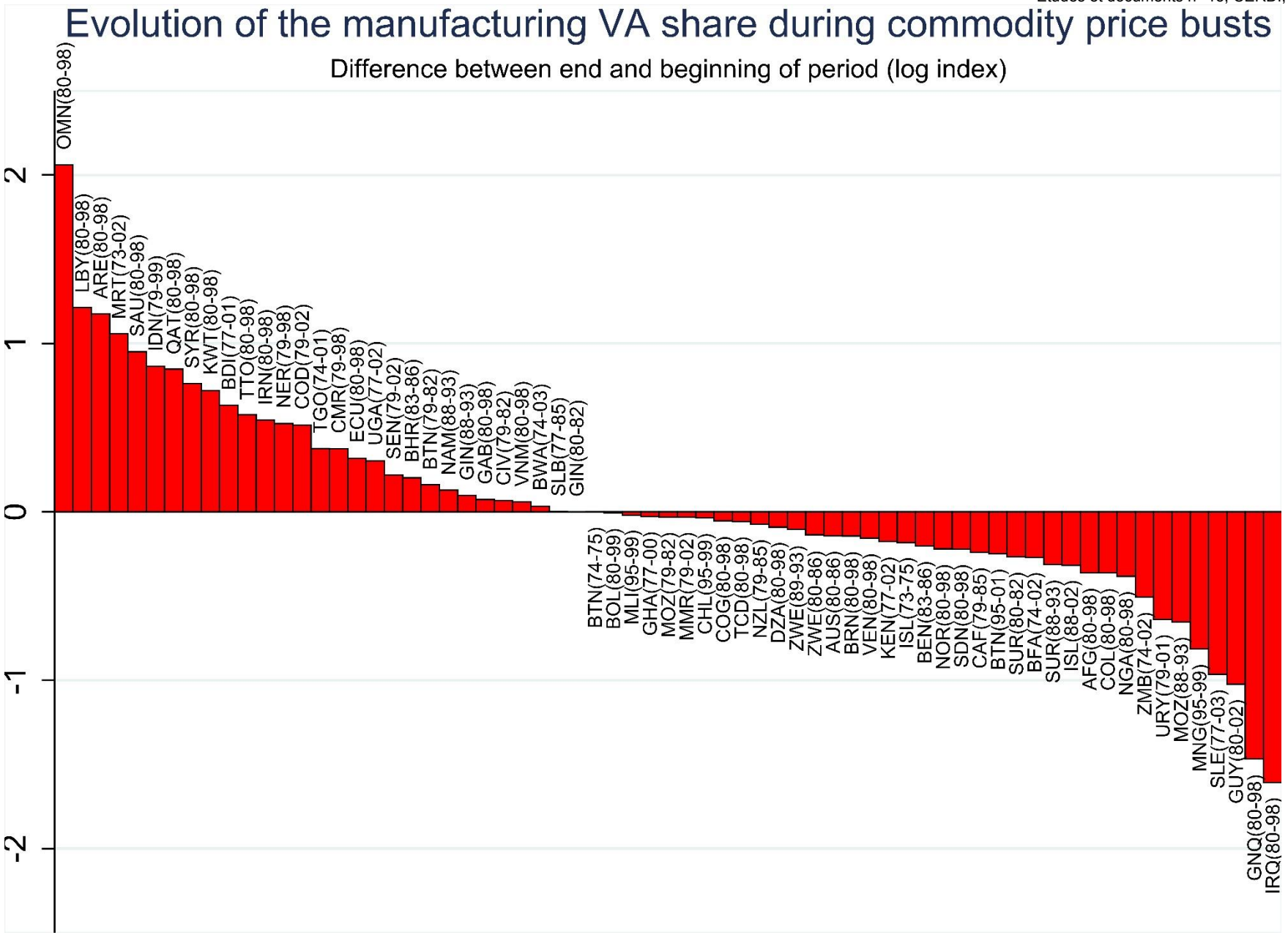
<u>Graph 3.b</u>: Evolution of the intensive margin index during commodity price busts



***Graph 3.c*: Evolution of the extensive margin index during commodity price busts**



<u>Graph 3.d</u>: Evolution of the relative quality index during commodity price busts



<u>Graph 3.e</u>: Evolution of the manufacturing VA share during commodity price busts

Conclusion

While resource-dependent countries currently face an overall commodity price bust, diversifying their economy turned out to be one of the preoccupations at the top of their policy agenda as soon as the commodity prices reversed.

In order to increase our knowledge on the relationship between commodity price booms or busts and the pattern of diversification, this paper has analyzed the impact of commodity price variations on diversification outcomes thanks to a panel of 78 countries over 1970-2012 using successively a cointegration methodology, a dynamic macro-panel model, as well as a discussion analyzing previously selected commodity price boom and bust episodes and the evolution of diversification patterns over these periods.

We have found a strong empirical evidence of a significant impact of commodity price increases on export concentration especially through a more concentrated mix of already exported products (intensive margin), which is robust to model specification, sample changes, as well as alternative control variables. However, we find weak to no evidence of the impact of commodity price variations on the extensive margin of export concentration, the relative quality of exported goods, or the evolution of the manufacturing value added share.

Going deeper into this relationship, we have evidenced that this positive relationship may arise through an increase of export concentration during commodity price booms and an increase of export diversification during commodity price busts. Based on a comparison between commodity booms in the 1970s and the 2000s, we have found some indications of a stronger increase of export concentration during the 2000s commodity price boom which may have increased the recent difficulties for highly resource-dependent countries to recover their economy in the context of current low commodity prices.

These results reveal a potential lack of interest from governments to support export diversification when commodity prices are booming. However, commodity prices rarely stay high forever and countries may have only started to implement reforms and investments to diversify when the price reversal left them with a very concentrated and natural resource dependent export basket. While commodity price booms can be an opportunity to diversify most countries did not seize it and may have waited the commodity price fall in order to put more emphasis on the diversification agenda.

Resource-dependent countries should put more focus on diversifying their economy as well as investing in key determinants while commodity prices are booming in order to prepare the economy for the following commodity price drop. Because some reforms such as easing in business creation or foreign direct investment legal conditions, as well as investments like transportation networks or human capital may impact economic diversification in the longer-run, officials should not wait too long before implementing these measures.

While we have been able to compare the diversification evolution between the 1970s and 2000s commodity price booms, it would be interesting to implement a same comparison between the 1980s-1990s commodity price drops and the recent period of commodity price fall. This empirical study would also gain from some analysis on the channels through which commodity price variations could impact export diversification but we leave this subject for further research.

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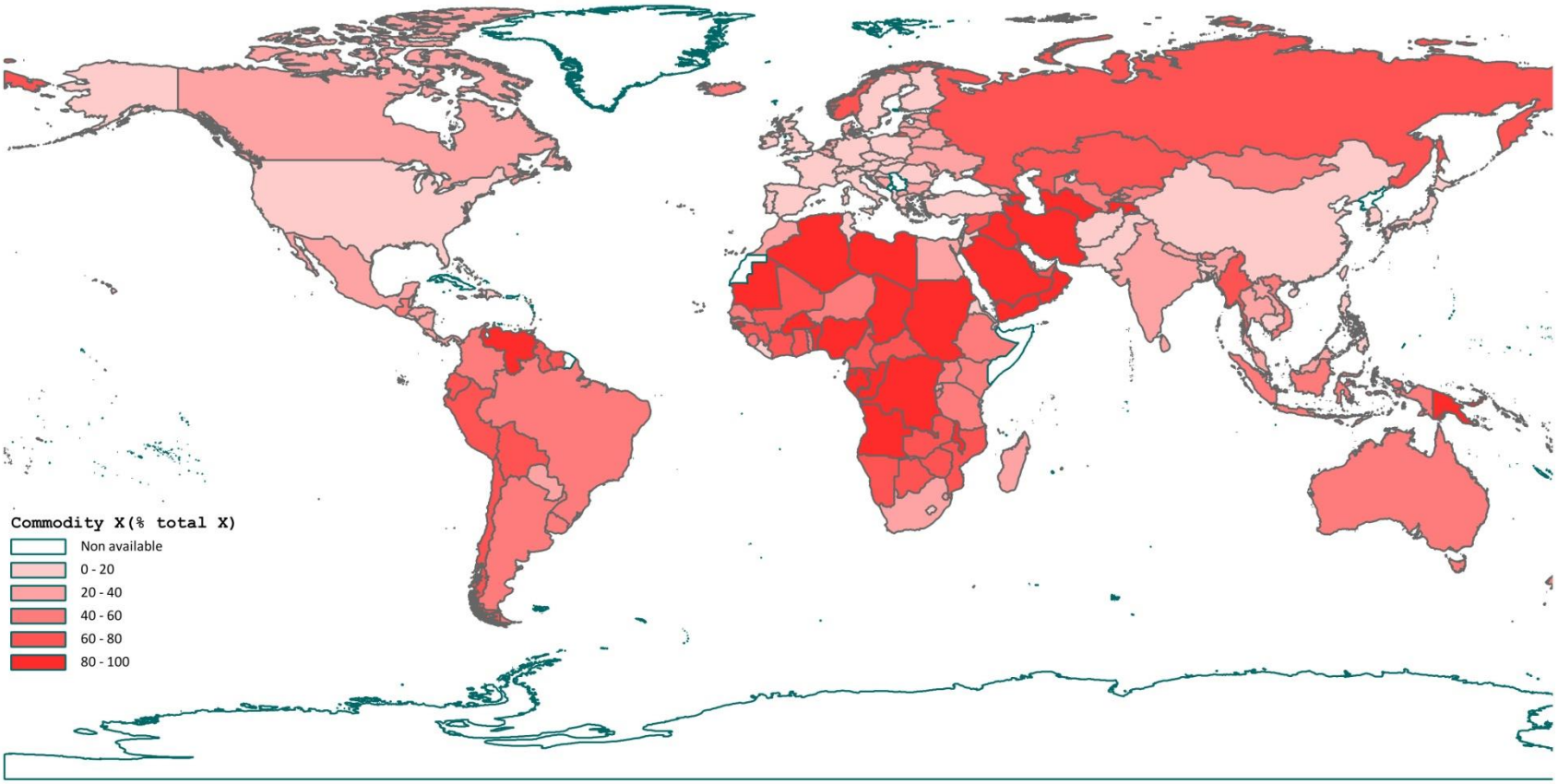
Appendices

Appendix 1: Geographical representation of resource-dependence for 2003-2007



Appendix 2: Aggregation of commodity exports

We compute natural resources exports merging data from UNCTAD for the period 1995-2012 and from COMTRADE when available before 1995.

One traditional drawback of these data is the problem of 0 values which are difficult to identify between a false or a true 0. While establishing a model to tackle this bias is beyond the scope of this paper, we benefit from UNCTAD data which complement COMTRADE data with estimates for missing values. As a result, this enables us to increase significantly our country coverage as well as to bypass this bias.

As it is standard in the literature we define exports by commodity groups defined according to the 3rd revision of the SITC such as:

-Agricultural raw materials=2-22-27-28

-Food=0+1+4+22

-Fuels=3

-Ores and metals=27+28+667+68+971

Appendix 3: Trade and price matching

Our first source of price data is the IFS who provides monthly commodity price series. When we decided to introduce other categories or to complement missing data we used data from UNCTAD. Every nominal commodity price index has been deflated by the US consumer price index and then deseasonalized thanks to the X12-ARIMA procedure of the Census Bureau.

As noticed by Medina (2010), the matching between trade data from the standard SITC and commodity price indices necessitate making some assumptions. First SITC categories (3rd revision) which are the closest possible from the definition of the commodity price series are matched to get exports data by commodity going up to a 5-digit categories level of accuracy in the SITC classification.

As stated above the importance of missing data in the COMTRADE database, motivated the use of UNCTAD data. However, the UNCTAD database provides estimates for missing data only at the 3-digit categories level. At this point we had to make additional assumptions.

Over the period 2003-2007, a coefficient catching the relative importance of the different commodities at the 4 or 5-digit level in each 3-digit category has been computed when the resources could have been identified with COMTRADE data and when they represent together a significant share of the 3-digit category aggregate. Because of missing data, this coefficient is identical for every country in the database and represents the global mean importance of these product categories which gives us a figure the least biased by missing data as possible.

In the tables below, the figures between brackets correspond to the number of commodities which are represented in the corresponding 3-digit category. For instance, the exports value from category 057 “Fruit and nuts (not including oil nuts), fresh or dried” has been split in constant shares between orange exports and bananas exports depending on the mean relative importance of sub-categories 0571 “Oranges, mandarins, clementines and similar citrus hybrids, fresh or dried” and 0573 “Bananas (including plantains), fresh or dried”.

Food products

Commodity	Mean weight	UNCTAD 3-digit SITC code (rev 3)	COMTRADE up to 5-digit SITC code (rev 3)	Data source
Bananas	2.57	057(2)	0573	UNCTAD
Beef	1.48	001(4), 011, 016(2), 017(3)	0011, 011, 01251, 01252, 01681, 0176	IMF
Cocoa	1.90	072, 073	072, 073	UNCTAD
Coconut oil	0.35	422(4)	4223	IMF
Coffee	3.13	071	071	IMF[1]
Copra	0.26	081(10), 223(3)	08137, 2231	IMF
Cottonseed oil	0.09	081(10), 222(4), 421(4)	08133, 2223, 4212	UNCTAD
Fish	3.43	034, 035, 037(2)	034, 035, 0371	IMF[2]
Fish meal	0.20	081(10)	08142	IMF
Groundnuts	0.12	081(10), 222(4)	08132, 2221	IMF
Groundnuts oil	0.26	421(4)	4213	IMF
Lamb	0.08	001(4), 012(3)	0012, 0121, 01255, 01256	IMF
Linseed oil	0.02	223(3), 422(4)	2234, 4221	IMF
Maize	0.28	044, 047, 081(10)	044, 04711, 04721, 05461, 08124	IMF
Orange	0.80	057(2), 059	0571, 0591	IMF[2]
Palm kernel oil	0.02	422(4)	4224	IMF
Palm oil	0.32	223(3), 422(4)	2232, 4222	IMF
Pepper	0.24	075	0751	UNCTAD
Rice	0.52	042, 081(10)	042, 08125	IMF
Shrimp	1.44	036, 037(2)	036, 0372	IMF
Soybean	0.50	222(4)	2222	IMF
Soybean meal	0.36	081(10), 098	08131, 09841	IMF
Soybean oil	0.14	421(4)	4211	IMF
Sugar	1.45	061, 062, 081(10)	05487, 05488, 06, 0815	IMF[1]
Sunflower oil	0.24	081(10), 222(4)	08135, 2224	IMF
Tea	0.82	074	074	IMF
Tobacco	1.77	121	121	IMF
Wheat	0.72	041, 046, 048, 081(10)	041, 046, 048, 08126	IMF

Agricultural raw materials

Commodity	Mean weight	UNCTAD 3-digit SITC code (rev 3)	COMTRADE up to 5-digit SITC code (rev 3)	Data source
Cotton	4.65	263	263	UNCTAD[1]
Hides	0.27	211, 212	211, 212	IMF
Rubber	0.36	231	23	IMF[1]
Timber	3.53	245, 246, 247, 248	24	IMF[1]
Wood pulp	0.25	251	251	IMF
Wool	0.39	268	268	IMF

Ores and metals

Commodity	Mean weight	UNCTAD 3-digit SITC code (rev 3)	COMTRADE up to 5-digit SITC code (rev 3)	Data source
Aluminum	5.24	285, 288(6), 684	285, 28823, 684	IMF
Copper	5.40	283, 288(6), 682	283, 28821, 682	IMF
Diamonds	4.36	667	667	IMF, Bloomberg[3]
Gold	4.49	971	971	IMF
Iron ore	1.49	281, 282	281, 282	IMF
Lead	0.18	287(3), 288(6), 685	2874, 28824, 685	IMF
Manganese ore	0.27	287(5)	2877	UNCTAD
Nickel	0.67	284, 288(6), 683	284, 28822, 683	IMF
Phosphate	0.17	272(2)	2723	IMF
Potash	0.09	272(2)	2724	IMF
Silver	0.44	289, 681	28911, 6811	IMF
Tin	0.38	287(5), 288(6), 687	2876, 28826, 687	IMF
Tungsten ore	0.07	287(5)	28792, 68911	UNCTAD
Uranium	0.66	286	2861	IMF
Zinc	0.83	287(5), 288(6), 686	2875, 28825, 686	IMF

Fuels

Commodity	Mean weight	UNCTAD 3-digit SITC code (rev 3)	COMTRADE up to 5-digit SITC code (rev 3)	Data source
Coal	1.02	321, 322, 325	32	IMF[2]
Crude oil	27.80	333	333	IMF[1]
Gasoline	7.31	334, 335	334, 335	IMF[2]
Natural gas	6.18	342, 343, 344	34	IMF[12]

Mean weight: Average time-invariant and country-specific weights over the whole sample.
3-digit (UNCTAD): Product codes following the SITC revision 3 classification.
Up to 5 digits (COMTRADE): Product codes following the SITC revision 3 classification.
In parenthesis, the number of commodity groups to which the 3-digit line refers (e.g. the line 037 includes both fish and shrimp). To disentangle the export value for each commodity group I compute the relative share of each commodity over the sample computed thanks to the average weights over the whole sample previously obtained thanks to the 5-digits COMTRADE data (e.g. fish will get 8.04/(8.04 +3.82) times the value of line 037).
[1]: Simple average of the available prices.
[2]: Computation of missing values thanks to the rate of growth of the closest commodity price available (crude oil price for coal, uranium, gasoline and natural gas; bananas price for oranges; and fish meal price for fish).
[3]: Diamond prices are only available on a daily basis over 2002-2012. Since this commodity group is the 6th most important in our basket, we didn't remove it and used the metal price index (weighted average of copper, aluminum, iron ore, tin, nickel, zinc, and lead prices) from the IMF instead of diamonds prices for previous variations.

Appendix 4: Commodity specialization patterns of resource-dependent countries

Low income countries

Country	% total exports					Main commodities in the CSCPI with corresponding weights computed over 2003-2007
	Raw agri	Food	Mining	Energy	Commodities	
Benin (BEN)	**48.7**	**22.0**	7.9	17.0	94.3	Cotton 49.2, Gasoline 17.4, Bananas 7.7
Chad (TCD)	17.3	0.1	0.1	**73.8**	91.3	Crude oil 75, Cotton 16.5, Gasoline 7.9
Guinea-Bissau (GNB)	1.1	**75.3**	0.5	7.0	84.0	Bananas 66.3, Orange 16.3, Crude oil 11.7
Tajikistan (TJK)	16.9	7.5	**70.5**	7.4	83.4	Aluminum 72.9, Cotton 19
Mauritania (MRT)	0.2	**34.7**	**39.9**	7.6	82.5	Iron ore 43.8, Fish 20.7, Crude oil 10.5, Copper 5.9
Burkina Faso (BFA)	**63.0**	15.9	1.8	0.2	81.0	Cotton 81.8
Dem. Rep. of Congo (COD)	5.7	2.1	**62.3**	10.8	80.9	Diamonds 44.7, Crude oil 13.4, Copper 9.8, Zinc 8.2, Timber 7.9
Guinea (GIN)	2.0	6.8	**58.3**	12.4	79.4	Aluminum 56.6, Crude oil 13.7, Copper 6.9
Mozambique (MOZ)	3.7	17.1	**46.3**	11.7	78.8	Aluminum 61.2, Tobacco 9.1, Shrimp 5.1
Mali (MLI)	**38.1**	4.4	**30.8**	0.4	73.6	Cotton 51.3, Gold 42
Zimbabwe (ZWE)	11.3	**26.9**	**30.3**	5.1	73.5	Nickel 34.1, Tobacco 25.3, Cotton 10.5, Coal 7.9, Gold 5.4
Central Afr. Rep. (CAF)	**35.4**	2.4	**33.9**	0.9	72.6	Timber 42, Diamonds 38.8, Cotton 12.1
Myanmar (MMR)	17.6	17.2	3.7	**28.0**	66.5	Natural gas 46.5, Timber 28.5, Shrimp 6.9
Burundi (BDI)	2.2	**34.7**	**20.4**	0.5	57.7	Coffee 51.5, Gold 30.9, Tea 5.2
Uganda (UGA)	7.6	**40.5**	5.7	0.9	54.6	Coffee 29.2, Fish 23.5, Tobacco 8.9, Gold 8.9, Cotton 6.8, Tea 5.6
Tanzania (TZA)	5.5	**22.6**	19.0	2.1	49.2	Gold 22.7, Fish 12.5, Tobacco 8.3, Silver 7.2, Copper 6.7, Coffee 6.7, Cotton 6
Niger (NER)	2.2	17.0	**20.3**	7.1	46.6	Uranium 42.9, Beef 18.3, Gasoline 14.7, Crude oil 7.6, Gold 5.5
Togo (TGO)	9.5	16.6	9.2	11.0	46.3	Gasoline 24.6, Cotton 19.6, Cocoa 13.3, Phosphate 11.2, Potash 5.9
Sierra Leone (SLE)	0.9	13.9	**29.6**	1.1	45.3	Diamonds 49.1, Coffee 21.5, Cocoa 6.8, Aluminum 6.1
Kenya (KEN)	8.3	**25.6**	2.2	7.1	43.2	Tea 37.7, Gasoline 25.7, Coffee 9.5, Fish 5.8
Kyrgyzstan (KGZ)	5.7	8.9	19.3	9.1	43.0	Gold 38.2, Gasoline 18.1, Cotton 11.3, Iron ore 7.2
Ethiopia (ETH)	8.4	**31.7**	2.9	0.0	43.0	Coffee 53.1, Soybean 10, Gold 9.1

Lower middle income countries

Country	% total exports					Main commodities in the CSCPI with corresponding weights computed over 2003-2007
	Raw agri	Food	Mining	Energy	Commodities	
Iraq (IRQ)	0.1	0.6	0.4	**98.0**	98.4	Crude oil 97.7
Papua New Guinea (PNG)	9.3	18.9	**41.4**	**23.7**	93.3	Crude oil 22.8, Copper 20.7, Gold 20.4, Timber 9.6
Nigeria (NGA)	0.3	1.4	0.3	**89.9**	92.0	Crude oil 89.8, Natural gas 5.9
Rep. of Congo (COG)	5.8	0.9	5.9	**79.2**	91.9	Crude oil 81, Timber 6.1
Sudan (SDN)	3.4	6.7	2.7	**74.0**	86.9	Crude oil 55, Gasoline 32.9
Malawi (MWI)	3.6	**79.8**	0.3	0.2	83.9	Tobacco 66.7, Sugar 12, Tea 8.4
Yemen (YEM)	0.3	4.5	1.6	**74.8**	81.3	Crude oil 85, Gasoline 7.7
Bolivia (BOL)	1.8	17.8	17.3	**41.8**	78.7	Natural gas 44.1, Crude oil 9.5, Tin 7.3
Zambia (ZMB)	4.0	9.3	**58.0**	0.9	72.2	Copper 77.9
Solomon Islands (SLB)	**52.3**	18.5	0.3	0.3	71.4	Timber 72.6, Fish 15.2
Guyana (GUY)	5.1	**33.4**	**28.3**	0.0	66.8	Sugar 25.1, Gold 22, Aluminum 11.7, Rice 10.2, Diamonds 8.4, Timber 7.7, Shrimp 6.9
Cote d'Ivoire (CIV)	7.5	**36.8**	0.5	**21.7**	66.4	Cocoa 41.7, Gasoline 21.6, Crude oil 11.7
Ghana (GHA)	5.5	**43.1**	11.3	4.2	64.1	Cocoa 54, Tea 7.3, Gold 5.9
Cameroon (CMR)	12.9	12.3	2.9	**35.1**	63.2	Crude oil 49, Timber 14.5, Cocoa 8.7, Gasoline 7.5, Bananas 5.4
Syria (SYR)	2.2	15.1	1.3	**43.1**	61.6	Crude oil 64.8, Gasoline 14.3
Mongolia (MNG)	5.6	1.5	**49.1**	3.2	59.4	Copper 50.8, Gold 22.3, Wool 8.6
Uzbekistan (UZB)	**22.8**	9.0	13.3	11.9	57.1	Cotton 41.6, Natural gas 19.1, Copper 11.8, Bananas 7, Gold 6.9
Indonesia (IDN)	4.8	10.7	7.6	**23.0**	46.1	Natural gas 20, Crude oil 17.1, Copper 10, Coal 9.5, Rubber 6.7, Coconut oil 6, Palm oil 5.4, Gasoline 5.3
Bhutan (BTN)	0.5	13.3	12.8	19.0	45.6	Copper 47, Bananas 10.4, Coconut oil 9.1, Palm oil 8.1
Armenia (ARM)	1.1	8.6	**32.9**	1.3	43.9	Diamonds 52.8, Copper 21.2, Aluminum 6
Vietnam (VNM)	2.8	18.0	0.7	**20.2**	41.7	Crude oil 45, Shrimp 13, Rice 7.9, Fish 6.7, Coffee 6.4, Rubber 5.1
Guatemala (GTM)	2.9	**31.3**	1.6	4.7	40.5	Coffee 21.7, Bananas 17.1, Sugar 16.1, Crude oil 10.3, Oranges 5
Senegal (SEN)	1.7	**22.2**	3.1	13.5	40.5	Gasoline 34.1, Fish 22.4, Shrimp 16.4, Crude oil 5.7

Upper middle income countries

Country	% total exports					Main commodities in the CSCPI with corresponding weights computed over 2003-2007
	Raw agri	Food	Mining	Energy	Commodities	
Angola (AFG)	0.0	0.1	2.2	**94.1**	96.4	Crude oil 95.7
Algeria (DZA)	0.0	0.2	0.5	**92.9**	93.6	Crude oil 53.8, Natural gas 36.4, Gasoline 9.1
Libya (LBY)	0.0	0.1	0.6	**88.3**	89.0	Crude oil 86.9, Gasoline 9.8
Gabon (GAB)	10.8	0.7	5.3	**69.1**	85.9	Crude oil 79.1, Timber 12.4
Turkmenistan (TKM)	2.5	0.1	0.6	**81.9**	85.1	Natural gas 78.2, Gasoline 14.5
Venezuela (VEN)	0.1	1.0	4.5	**77.2**	82.8	Crude oil 76, Gasoline 16.6
Azerbaijan (AZE)	1.1	4.0	2.7	**75.0**	82.7	Crude oil 73.5, Gasoline 18.4
Iran (IRN)	0.4	2.5	2.2	**75.1**	80.1	Crude oil 89.7
Ecuador (ECU)	3.9	**26.4**	0.6	**47.7**	78.6	Crude oil 59.2, Bananas 12.1, Shrimp 7.1, Gasoline 5.6, Fish 5
Kazakhstan (KAZ)	0.8	3.5	14.2	**59.6**	78.0	Crude oil 69.3, Copper 7.6
Botswana (BWA)	0.1	2.0	**73.2**	0.1	75.5	Diamonds 81.2, Copper 8.3, Nickel 7.2
Peru (PER)	1.4	14.7	**52.1**	6.8	75.0	Copper 27.2, Gold 22.6, Zinc 7.8, Gasoline 7.1, Tin 5.2
Suriname (SUR)	0.5	11.4	**58.5**	3.7	74.0	Aluminum 53.9, Gold 26.6, Gasoline 5
Chile (CHL)	5.8	16.9	**48.7**	2.0	73.3	Copper 62.4, Fish 7, Bananas 6
Russia (RUS)	2.6	1.6	7.2	**52.8**	64.1	Crude oil 44, Natural gas 18.6, Gasoline 18.3
Namibia (NAM)	0.6	**24.4**	**36.5**	1.0	62.5	Diamonds 33.2, Fish 25.4, Zinc 15.2, Uranium 6.8, Copper 5.7, Beef 5.3
Argentina (ARG)	1.2	**40.8**	3.7	13.0	58.7	Gasoline 10.9, Crude oil 9.7, Wheat 8.4, Soybean meal 7.5, Maize 6.3, Soybean 5.2, Natural gas 5.1
Colombia (COL)	4.0	14.2	4.7	**32.3**	55.1	Crude oil 32.3, Coal 20.1, Gasoline 11.9, Coffee 11.8, Gold 5.9
Uruguay (URY)	6.9	**36.8**	1.3	2.5	47.5	Beef 36.7, Rice 11.5, Wool 8.5, Timber 7.1, Fish 6.5, Gasoline 5.8
Brazil (BRA)	3.5	**23.4**	9.4	5.6	41.9	Iron ore 14.1, Crude oil 9.5, Sugar 8.8, Aluminum 6.3, Soybean 6.3, Gasoline 5.9, Coffee 5.6, Beef 5

High income countries

Country	% total exports					Main commodities in the CSCPI with corresponding weights computed over 2003-2007
	Raw agri	Food	Mining	Energy	Commodities	
Equatorial Guinea (GNQ)	2.1	0.1	0.0	**90.7**	92.9	Crude oil 94.1
Saudi Arabia (SAU)	0.1	0.8	0.6	**81.9**	83.4	Crude oil 85.1, Gasoline 9.6
Oman (OMN)	0.0	2.6	0.9	**79.8**	83.3	Crude oil 78.6, Natural gas 16.9
Brunei (BRN)	0.0	0.1	0.4	**82.4**	83.0	Crude oil 62.9, Natural gas 36.2
Kuwait (KWT)	0.1	0.3	0.7	**78.1**	79.2	Crude oil 68.3, Gasoline 26.2
Qatar (QAT)	0.0	0.1	0.3	**76.8**	77.2	Crude oil 59.4, Natural gas 34.6, Gasoline 5.6
United Arab Emirates (ARE)	0.2	2.9	9.6	**60.2**	72.9	Crude oil 65.6, Gasoline 11.7, Natural gas 6.9
Trinidad and Tobago (TTO)	0.0	2.7	1.0	**59.9**	63.6	Natural gas 46.9, Gasoline 32.1, Crude oil 17.3
Norway (NOR)	0.4	4.1	5.4	**50.1**	60.1	Crude oil 56, Natural gas 22.9, Fish 6, Aluminum 5.5, Gasoline 5.4
Bahrain (BHR)	0.0	1.2	**26.8**	**29.4**	57.4	Gasoline 48.3, Aluminum 36.5, Iron ore 6.5
Australia (AUS)	3.1	12.5	**22.2**	17.2	55.0	Coal 19.9, Iron ore 11.7, Aluminum 11.1, Gold 8.3, Crude oil 6.9, Beef 5.9, Copper 5.4, Natural gas 5.1
Iceland (ISL)	0.5	**35.8**	13.9	0.8	51.0	Fish 60.2, Aluminum 27.4
New Zealand (NZL)	7.6	**34.7**	3.7	1.9	47.8	Beef 18.3, Timber 14.1, Aluminum 10.6, Bananas 9.2, Fish 7.3, Wool 6.9, Crude oil 5.5, Wood pulp 5.3

Appendix 5: REER computation

In order to maximize our country and time coverage, we compute our own REER series for each countries using a unified procedure based on UNCTAD trade data.

First, we have computed yearly trade weights using a methodology close to Bayoumi et al (2006) even though we distinguish 5 categories of traded goods.

Goods	SITC rev 3 classification
Food	0+1+22+4
Raw agricultural materials	2-22-27-28
Mining and mineral products	27+28+68+667+971
Fuels	3
Manufacturing	5+6+7+8-667-68

This weighting scheme takes into account potential 3rd market effects in the manufacturing sector, assign manufacturing weights for service trade, and compute separately weights for the 4 other categories of commodities. While fuels and minerals are often excluded from the trade figures used to compute these weights, it seems problematic when we focus entirely in resource-dependent countries whose commodity exports dominate their trade pattern. As a result, we didn't remove those flow because we feel it can proxy potential trade networks between two countries which could be activated one day or the other in order to trade non-commodity goods, and we would lose some information removing those.

The final weight is a weighting average of the 5 category weights and has been computed for each economy-partner pair for each year over 1995-2011. We use the median weight obtained normalized so that each year-specific sum of these new weights sum up to 1.

Even though it is standard in the literature to use the CPI when one what to maximize its country and time coverage, we prefer GDP deflators as our proxies of domestic price factors. In fact, while it seems important to take into account the trending importance of the global value chain, it is difficult to use value added based trade weights. However, it has motivated our choice of GDP deflator as our preferred proxy in order to catch the price linked to produced value added.

We use GDP deflators from the PWT 8.0 because it maximizes our coverage so that our REER is available for 188 over 1990-2011 and for 161 countries over 1970-1989. As robustness checks, we have also computed REER based on the GDP deflator from the WEO and a REER based on the CPI from the WEO.

The complete description for the computation of the trade weights and the final indices may be published in a future draft.

Appendix 6: CCEMG estimations with variables in diff-log form

Specifications using the concentration index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Conc index)						
Δln(CSCPI)	0.103***	0.102***	0.114***	0.140***	0.112***	0.137***	0.116***
	(3.861)	(5.203)	(6.085)	(3.524)	(4.692)	(6.316)	(5.006)
Δln(REER)	0.052**	0.034	0.010	0.047*	0.023	0.032*	0.017
	(2.379)	(1.631)	(0.407)	(1.903)	(1.069)	(1.705)	(0.776)
Δln(GFCFshare)	-0.017	-0.003	-0.048***	-0.014	-0.003	-0.001	-0.009
	(-1.259)	(-0.343)	(-2.870)	(-0.861)	(-0.354)	(-0.064)	(-0.662)
Δln(School)	-0.060*	-0.003	-0.045	-0.039	-0.054	-0.024	-0.044
	(-1.948)	(-0.084)	(-1.470)	(-1.034)	(-1.503)	(-0.792)	(-1.269)
Δvol(CSCPI)	-0.001						
	(-0.235)						
Δln(Pop active)		-0.666					
		(-1.594)					
$\Delta\ln(\frac{M}{GDP})$			0.005				
			(0.258)				
Δln(Financial dev)				-0.006			
				(-0.352)			
ΔCapital open					0.013		
					(0.396)		
ΔDemocracy level						-0.009	
						(-0.418)	
Δln(PPP GDP pc)							0.058
							(1.303)
N	1662	1659	1662	1360	1496	1604	1577
N of countries	67	67	67	60	65	66	65
Wald Chi²	26.002	32.398	47.652	17.976	25.695	43.612	29.411
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the intensive margin index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Int margin)						
Δln(CSCPI)	0.073**	0.117***	0.091***	0.131***	0.086***	0.141***	0.098***
	(2.247)	(4.453)	(3.690)	(3.229)	(3.321)	(4.719)	(3.691)
Δln(REER)	0.030	0.032	0.030	0.018	0.011	0.004	-0.003
	(1.404)	(1.401)	(1.372)	(0.418)	(0.390)	(0.201)	(-0.118)
Δln(GFCFshare)	-0.034*	-0.027	-0.047***	-0.016	-0.006	-0.010	-0.010
	(-1.784)	(-1.570)	(-2.853)	(-0.772)	(-0.486)	(-0.635)	(-0.528)
Δln(School)	-0.087*	-0.041	-0.051	-0.055	-0.016	-0.035	-0.063
	(-1.686)	(-0.905)	(-1.222)	(-1.099)	(-0.410)	(-0.669)	(-1.366)
Δvol(CSCPI)	0.002						
	(0.448)						
Δln(Pop active)		-0.131					
		(-0.283)					
$\Delta\ln(\frac{M}{GDP})$			0.015				
			(0.764)				
Δln(Financial dev)				-0.006			
				(-0.326)			
ΔCapital open					0.013		
					(0.453)		
ΔDemocracy level						0.009	
						(0.362)	
Δln(PPP GDP pc)							-0.043
							(-0.637)
N	1662	1659	1662	1360	1496	1604	1577
N of countries	67	67	67	60	65	66	65
Wald Chi²	13.247	25.157	25.716	12.513	11.793	23.291	16.190
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the extensive margin index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Ext margin)						
Δln(CSCPI)	0.150*	0.216***	0.136**	0.180	0.075	0.158**	0.148
	(1.657)	(2.807)	(2.262)	(1.534)	(0.796)	(2.386)	(1.626)
Δln(REER)	0.095	0.024	0.077	-0.018	-0.082	0.018	-0.010
	(1.350)	(0.211)	(0.916)	(-0.187)	(-0.970)	(0.214)	(-0.125)
Δln(GFCFshare)	0.053	0.022	0.061	0.019	0.010	0.037	0.080
	(0.761)	(0.405)	(0.843)	(0.332)	(0.175)	(0.619)	(1.332)
Δln(School)	-0.206	0.054	-0.173	0.041	-0.108	0.013	-0.249*
	(-1.370)	(0.403)	(-0.990)	(0.392)	(-0.675)	(0.089)	(-1.689)
Δvol(CSCPI)	-0.052***						
	(-2.878)						
Δln(Pop active)		-1.954					
		(-0.722)					
$\Delta\ln(\frac{M}{GDP})$			-0.044				
			(-0.698)				
Δln(Financial dev)				0.036			
				(0.721)			
ΔCapital open					-0.009		
					(-0.129)		
ΔDemocracy level						0.021	
						(0.369)	
Δln(PPP GDP pc)							0.176
							(0.802)
N	1622	1619	1622	1345	1468	1565	1544
N of countries	67	67	67	60	65	66	65
Wald Chi²	15.308	8.770	8.136	3.172	2.077	6.267	7.928
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the relative quality index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Quality index)						
Δln(CSCPI)	0.031	-0.030	-0.008	0.008	-0.013	-0.023	-0.021
	(1.029)	(-1.064)	(-0.273)	(0.224)	(-0.467)	(-0.758)	(-0.800)
Δln(REER)	-0.016	-0.008	0.002	-0.062*	-0.035	-0.024	-0.015
	(-0.611)	(-0.307)	(0.049)	(-1.804)	(-1.058)	(-1.114)	(-0.503)
Δln(GFCFshare)	0.023	0.037**	0.008	0.037**	0.024	0.021	0.021
	(1.159)	(2.454)	(0.496)	(2.067)	(1.517)	(1.100)	(1.261)
Δln(School)	-0.015	-0.010	0.027	0.008	-0.001	-0.021	0.004
	(-0.318)	(-0.208)	(0.697)	(0.251)	(-0.024)	(-0.463)	(0.111)
Δvol(CSCPI)	-0.004						
	(-1.435)						
Δln(Pop active)		-0.128					
		(-0.248)					
$\Delta\ln(\frac{M}{GDP})$			0.024				
			(1.141)				
Δln(Financial dev)				-0.000			
				(-0.009)			
ΔCapital open					0.005		
					(0.232)		
ΔDemocracy level						-0.016	
						(-0.594)	
Δln(PPP GDP pc)							0.018
							(0.343)
N	1565	1562	1565	1270	1421	1508	1501
N of countries	65	65	65	58	63	64	63
Wald Chi²	4.934	7.356	2.111	7.641	3.695	3.594	2.614
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the manufacturing VA share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Manu share)						
Δln(CSCPI)	-0.005	-0.012	0.015	-0.021	-0.059	-0.076*	0.017
	(-0.097)	(-0.292)	(0.393)	(-0.375)	(-0.967)	(-1.721)	(0.413)
Δln(REER)	-0.183***	-0.195***	-0.141***	-0.095	-0.091	-0.109**	-0.191***
	(-3.613)	(-4.162)	(-3.075)	(-1.412)	(-1.408)	(-2.131)	(-3.332)
Δln(GFCFshare)	0.073**	0.060**	0.024	0.048*	0.092***	0.056*	0.057**
	(2.377)	(2.220)	(0.762)	(1.708)	(3.008)	(1.707)	(1.994)
Δln(School)	0.001	0.012	0.066	-0.063	-0.005	0.017	0.007
	(0.013)	(0.172)	(1.004)	(-0.729)	(-0.060)	(0.228)	(0.083)
Δvol(CSCPI)	-0.004						
	(-0.625)						
Δln(Pop active)		-0.633					
		(-1.047)					
$\Delta\ln(\frac{M}{GDP})$			0.021				
			(0.537)				
Δln(Financial dev)				-0.018			
				(-0.548)			
ΔCapital open					0.006		
					(0.152)		
ΔDemocracy level						0.014	
						(0.586)	
Δln(PPP GDP pc)							-0.230***
							(-2.619)
N	1816	1813	1816	1460	1591	1707	1694
N of countries	72	72	72	65	69	69	69
Wald Chi²	19.106	23.461	11.485	5.887	11.992	10.809	22.113
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Appendix 7: CCEMG estimations with the lagged log form of the dependent variable

Specifications using the concentration index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Conc index)						
$\ln(\text{Conc index})_{t-1}$	-0.520***	-0.651***	-0.575***	-0.645***	-0.593***	-0.598***	-0.591***
	(-9.836)	(-13.320)	(-12.106)	(-12.463)	(-11.996)	(-12.772)	(-12.417)
Δln(CSCPI)	0.064***	0.049***	0.073***	0.068***	0.060***	0.058***	0.064***
	(3.163)	(2.804)	(4.436)	(2.877)	(3.059)	(3.346)	(4.138)
Δln(REER)	0.025*	0.032**	0.015	0.019	0.018	0.014	0.023
	(1.858)	(2.469)	(1.183)	(1.125)	(1.604)	(1.139)	(1.637)
Δln(GFCFshare)	-0.012	-0.013	-0.002	-0.020*	-0.026**	-0.009	-0.017*
	(-1.187)	(-1.511)	(-0.185)	(-1.764)	(-2.566)	(-0.812)	(-1.730)
Δln(School)	-0.060**	-0.067**	-0.062**	-0.104***	-0.091***	-0.078***	-0.059**
	(-2.415)	(-2.183)	(-2.355)	(-3.203)	(-2.966)	(-2.798)	(-2.172)
Δvol(CSCPI)	0.001						
	(0.427)						
Δln(Pop active)		-0.062					
		(-1.227)					
$\Delta\ln(\frac{M}{GDP})$			-0.007				
			(-0.408)				
Δln(Financial dev)				0.020**			
				(2.509)			
ΔCapital open					0.025		
					(1.003)		
ΔDemocracy level						-0.002	
						(-0.138)	
Δln(PPP GDP pc)							0.031
							(1.357)
N	2386	2383	2386	2002	2190	2310	2272
N of countries	72	72	72	69	72	71	72
Wald Chi^2	117.619	199.932	173.384	184.520	172.232	184.113	183.532
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the intensive margin index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Int margin)						
$\ln(\text{Int margin})_{t-1}$	-0.517***	-0.678***	-0.566***	-0.625***	-0.590***	-0.627***	-0.604***
	(-11.635)	(-15.709)	(-12.554)	(-12.415)	(-13.533)	(-15.372)	(-12.897)
Δln(CSCPI)	0.049**	0.059***	0.057***	0.068***	0.081***	0.061***	0.058***
	(2.470)	(3.112)	(2.904)	(3.142)	(4.141)	(3.584)	(3.352)
Δln(REER)	0.021	0.024	0.026	0.023	0.008	0.010	0.023
	(1.252)	(1.392)	(1.403)	(1.116)	(0.586)	(0.749)	(1.416)
ln(GFCFshare)	-0.026**	-0.016	-0.016	-0.004	-0.015	-0.005	-0.021*
	(-2.524)	(-1.348)	(-1.173)	(-0.279)	(-1.165)	(-0.426)	(-1.652)
ln(School)	-0.037	-0.018	0.015	-0.029	-0.042	-0.043	-0.017
	(-1.492)	(-0.476)	(0.464)	(-0.911)	(-1.216)	(-1.224)	(-0.543)
vol(CSCPI)	-0.002						
	(-0.819)						
ln(Pop active)		-0.011					
		(-0.145)					
$\ln(\frac{M}{GDP})$			-0.004				
			(-0.171)				
ln(Financial dev)				0.017**			
				(1.964)			
Capital open					0.049*		
					(1.713)		
Democracy level						0.003	
						(0.157)	
ln(PPP GDP pc)							0.066**
							(2.078)
N	2386	2383	2386	2002	2190	2310	2272
N of countries	72	72	72	69	72	71	72
Wald Chi^2	152.315	260.458	169.623	170.012	206.398	251.410	186.920
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the extensive margin index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Ext margin)						
$\ln(\text{Ext margin})_{t-1}$	-0.615***	-0.748***	-0.686***	-0.706***	-0.708***	-0.714***	-0.706***
	(-13.088)	(-15.116)	(-14.639)	(-13.029)	(-13.856)	(-15.272)	(-13.551)
Δln(CSCPI)	0.039	0.020	0.078	0.103	0.045	0.033	-0.017
	(0.652)	(0.350)	(1.429)	(1.509)	(0.911)	(0.755)	(-0.296)
Δln(REER)	0.016	-0.006	0.037	-0.083	-0.011	0.007	-0.051
	(0.402)	(-0.124)	(0.676)	(-1.386)	(-0.173)	(0.146)	(-0.829)
ln(GFCFshare)	-0.020	0.011	-0.013	-0.059	-0.033	-0.011	0.010
	(-0.521)	(0.383)	(-0.354)	(-1.139)	(-0.900)	(-0.254)	(0.256)
ln(School)	-0.075	-0.132	-0.113	-0.096	-0.128	-0.159	-0.090
	(-0.769)	(-1.255)	(-1.133)	(-0.912)	(-1.570)	(-1.462)	(-1.144)
vol(CSCPI)	-0.020						
	(-1.412)						
ln(Pop active)		-0.386*					
		(-1.956)					
$\ln(\frac{M}{GDP})$			-0.067				
			(-1.268)				
ln(Financial dev)				-0.007			
				(-0.212)			
Capital open					0.032		
					(0.609)		
Democracy level						0.013	
						(0.191)	
ln(PPP GDP pc)							0.057
							(0.584)
N	2317	2314	2317	1958	2135	2244	2210
N of countries	72	72	72	68	72	71	72
Wald Chi²	174.744	234.173	219.812	176.119	196.489	236.069	186.118
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the relative quality index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Quality index)						
ln(Quality index)$_{t-1}$	-0.564***	-0.650***	-0.599***	-0.691***	-0.602***	-0.655***	-0.680***
	(-12.746)	(-13.881)	(-13.204)	(-12.563)	(-12.520)	(-12.812)	(-12.485)
Δln(CSCPI)	-0.022	-0.022	0.000	-0.014	-0.007	0.003	-0.002
	(-1.234)	(-1.373)	(0.008)	(-0.689)	(-0.408)	(0.164)	(-0.069)
Δln(REER)	-0.014	0.006	-0.001	-0.008	-0.007	0.005	0.011
	(-1.024)	(0.369)	(-0.071)	(-0.475)	(-0.468)	(0.379)	(0.807)
ln(GFCFshare)	0.001	0.004	0.003	0.012	-0.007	0.004	-0.013
	(0.133)	(0.458)	(0.239)	(0.857)	(-0.684)	(0.395)	(-1.261)
ln(School)	-0.001	-0.010	-0.012	-0.016	0.008	0.001	0.003
	(-0.049)	(-0.308)	(-0.359)	(-0.413)	(0.306)	(0.045)	(0.109)
vol(CSCPI)	0.004						
	(1.405)						
ln(Pop active)		0.018					
		(0.248)					
$\ln(\frac{M}{GDP})$			0.005				
			(0.359)				
ln(Financial dev)				0.014			
				(1.265)			
Capital open					0.003		
					(0.112)		
Democracy level						0.017	
						(1.225)	
ln(PPP GDP pc)							0.010
							(0.300)
N	2279	2276	2279	1902	2106	2204	2192
N of countries	72	72	72	69	72	71	72
Wald Chi²	167.029	195.071	174.658	161.038	157.716	165.988	158.219
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Specifications using the manufacturing VA share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δln(Manu share)						
$\ln(\text{Manu share})_{t-1}$	-0.445***	-0.522***	-0.489***	-0.560***	-0.464***	-0.519***	-0.529***
	(-13.062)	(-15.357)	(-14.592)	(-13.379)	(-12.178)	(-15.570)	(-13.671)
Δln(CSCPI)	-0.051	-0.035	-0.031	-0.044	-0.016	-0.060*	-0.037
	(-1.569)	(-1.252)	(-0.847)	(-1.085)	(-0.357)	(-1.767)	(-1.008)
Δln(REER)	-0.054**	-0.065**	-0.060**	-0.082**	-0.135***	-0.066**	-0.061**
	(-2.159)	(-2.231)	(-2.038)	(-1.973)	(-3.237)	(-2.312)	(-2.026)
ln(GFCFshare)	-0.018	-0.010	-0.010	-0.018	-0.009	-0.007	0.008
	(-0.827)	(-0.488)	(-0.358)	(-0.694)	(-0.321)	(-0.333)	(0.264)
ln(School)	0.020	0.019	-0.023	0.019	0.046	0.022	0.009
	(0.508)	(0.291)	(-0.517)	(0.294)	(0.791)	(0.431)	(0.209)
vol(CSCPI)	-0.004						
	(-0.724)						
ln(Pop active)		-0.018					
		(-0.128)					
$\ln(\frac{M}{GDP})$			0.044				
			(1.333)				
ln(Financial dev)				0.015			
				(0.705)			
Capital open					-0.003		
					(-0.099)		
Democracy level						0.017	
						(0.630)	
ln(PPP GDP pc)							-0.010
							(-0.146)
N	2601	2598	2601	2146	2327	2476	2461
N of countries	76	76	76	73	75	74	76
Wald Chi²	179.220	242.712	219.966	185.128	159.644	251.603	192.158
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01							

The constant is not reported in the table above

Appendix 8: CCEMG estimations without small countries

We exclude from the sample countries with an average population over the sample below 1 million inhabitants so that we exclude Iceland, Guyana, Suriname, Bahrain, Bhutan, Equatorial Guinea, and Solomon Islands.

	(1)	(2)	(3)	(4)	(5)
	Δln(Conc index)	Δln(Int margin)	Δln(Ext margin)	Δln(Quality index)	Δln(Manu share)
Δln(CSCPI)	0.142***	0.120***	0.130*	-0.027	-0.054*
	(5.429)	(3.796)	(1.699)	(-1.302)	(-1.772)
Δln(REER)	0.045***	0.057***	-0.040	-0.016	-0.043
	(3.083)	(3.315)	(-0.841)	(-1.155)	(-1.292)
ln(GFCFshare)	-0.015*	-0.016**	0.005	0.013	-0.006
	(-1.852)	(-2.250)	(0.119)	(1.622)	(-0.346)
ln(School)	-0.024**	0.012	-0.171***	-0.013	0.034
	(-2.034)	(0.791)	(-2.722)	(-1.003)	(1.093)
vol(CSCPI)	-0.004	-0.006	-0.024	0.004	-0.003
	(-1.357)	(-1.463)	(-1.618)	(1.372)	(-0.378)
N	2125	2125	2097	2035	2302
N of countries	65	65	65	65	68
Wald Chi²	48.386	33.226	13.638	8.548	6.266
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01					

The constant is not reported in the table above

Appendix 9: CCEMG estimations without countries from the OPEC

We exclude countries who have been for at least 10 years during our time period members of the Organization of the Petroleum Exporting Countries (OPEC) which includes every current member (Algeria, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela) apart from Angola which has joined the organization in 2007, as well as Gabon which was a former member from 1975 to 1994.

	(1)	(2)	(3)	(4)	(5)
	Δln(Conc index)	Δln(Int margin)	Δln(Ext margin)	Δln(Quality index)	Δln(Manu share)
Δln(CSCPI)	0.130***	0.106***	0.194*	-0.022	0.012
	(4.848)	(3.581)	(1.776)	(-0.919)	(0.374)
Δln(REER)	0.033**	0.051**	-0.122*	-0.010	-0.083**
	(2.055)	(1.970)	(-1.701)	(-0.615)	(-2.051)
ln(GFCFshare)	-0.013	-0.008	0.001	0.001	0.003
	(-1.569)	(-0.718)	(0.011)	(0.079)	(0.168)
ln(School)	-0.023	0.035*	-0.245**	-0.005	-0.017
	(-1.261)	(1.726)	(-2.416)	(-0.428)	(-0.582)
vol(CSCPI)	-0.005*	-0.007	-0.014	0.005	-0.001
	(-1.803)	(-1.499)	(-0.778)	(0.997)	(-0.142)
N	1925	1925	1856	1893	2130
N of countries	59	59	59	60	63
Wald Chi²	35.027	22.444	12.488	2.407	4.734
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01					

The constant is not reported in the table above

Appendix 10: CCEMG estimations with alternative REER variables

As explained in appendix 5, we have computed two others REER series so we will check the sensitivity of our results to the change of our REER variable. The first table uses the REER based on the GDP deflator from the WEO instead of the PWT 8.0., while the second table uses REER computed with CPI from the WEO.

Specifications using the REER computed thanks to the GDP deflator from the WEO

	(1)	(2)	(3)	(4)	(5)
	Δln(Conc index)	Δln(Int margin)	Δln(Ext margin)	Δln(Quality index)	Δln(Manu share)
Δln(CSCPI)	0.109***	0.100***	0.258***	-0.017	-0.043
	(4.670)	(4.300)	(3.221)	(-0.882)	(-1.039)
Δln(REER)	0.015	0.041**	-0.096	-0.020	-0.063*
	(1.153)	(1.975)	(-1.047)	(-1.254)	(-1.797)
ln(GFCFshare)	-0.011	-0.007	-0.004	0.023***	-0.038
	(-1.576)	(-0.943)	(-0.106)	(2.820)	(-1.628)
ln(School)	-0.017	0.018	-0.203***	-0.005	-0.002
	(-1.350)	(1.096)	(-2.899)	(-0.435)	(-0.060)
vol(CSCPI)	-0.002	-0.006**	-0.000	0.002	-0.002
	(-1.308)	(-2.145)	(-0.019)	(0.656)	(-0.282)
N	2223	2223	2161	2144	2411
N of countries	70	70	70	70	75
Wald Chi²	29.152	29.086	19.882	10.922	7.039
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01					

The constant is not reported in the table above

Specifications using the REER computed thanks to the CPI from the WEO

	(1)	(2)	(3)	(4)	(5)
	Δln(Conc index)	Δln(Int margin)	Δln(Ext margin)	Δln(Quality index)	Δln(Manu share)
Δln(CSCPI)	0.125***	0.114***	0.204**	-0.013	-0.049
	(5.629)	(4.581)	(2.457)	(-0.706)	(-1.192)
Δln(REER)	0.004	0.011	-0.108	-0.025	0.001
	(0.246)	(0.519)	(-1.116)	(-1.552)	(0.029)
ln(GFCFshare)	-0.010	-0.006	-0.019	0.019*	-0.010
	(-1.252)	(-0.662)	(-0.493)	(1.883)	(-0.426)
ln(School)	-0.010	0.011	-0.221***	-0.022*	-0.019
	(-0.895)	(0.843)	(-2.636)	(-1.785)	(-0.653)
vol(CSCPI)	-0.003*	-0.006**	-0.002	0.007*	-0.002
	(-1.944)	(-2.300)	(-0.115)	(1.756)	(-0.256)
N	2203	2203	2141	2124	2394
N of countries	70	70	70	70	75
Wald Chi²	37.891	27.694	14.488	12.721	2.094
* P-Value<0.10, ** P-Value <0.05, *** P-Value <0.01					

The constant is not reported in the table above